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The Mount Vernon and Agamemnon

NOW that the Congress has failed to provide for the immediate construction of new passenger vessels for the North Atlantic service, the United States Lines have been brought face to face with a most serious situation. Practically every foreign country having important interests in the passenger business between America and Europe has under construction fine vessels of the most modern type and in certain instances of greater speed than any yet built. Nothing is more certain than that in about two years time a keen competition for this business will arise—keener than anything which has preceded it. To meet this, so far as can now be seen, the United States Lines will have—its present vessels. Even if new ships were started now, it would take much more than two years to complete them so that unless something radical in the way of reconditioning present tonnage is immediately got under way, the prospects of successfully maintaining the present service, to say nothing of meeting the competition of the new foreign ships, are dark indeed.

Fortunately, two very good ships are available, neither of them older than are a large proportion of the North Atlantic passenger ships at present in service and both, so far as their hulls are concerned, in excellent condition. The *Mt. Vernon* and *Agamemnon* were, before the war, two of the most popular vessels on the Atlantic and among the fastest. The reciprocating engines which propelled them, 4 in each vessel, were the largest of their type ever constructed but measured by today's standards their propelling machinery is inefficient and unable to compete on anything like equal terms with the present high pressure, geared turbine installations. Their passenger quarters have, in large part, been removed but in any event would have to be entirely replaced to meet the present requirements of first class travel on the Atlantic. In these two vessels lies, apparently, the only hope for the maintenance, by the United States Lines, of a first class service until new vessels can be built and put in commission.

What can best be done with them? The first and most obvious answer is to give them new quarters and make no changes in their present machinery except possibly to convert them from coal to oil burners. This would cost probably between $3,000,000 and $4,000,000 for each ship, the result being a pair of commercially "impossible" ships; first, on account of their enormous fuel consumption and second because of the very limited passenger accommodations possible with the present arrangement of uptakes and machinery casings.

A very careful study of the ships has resulted in a proposal which while the first cost will be large is, in the practical commercial results to be obtained, nothing less than "an inspiration of genius." Briefly it is now proposed to replace the present engines and boilers by modern geared turbines and watertube boilers. This will result in a gain in deadweight carrying capacity of something over 4,000 tons and in passenger accommodation of 25 percent on each vessel. Thus sufficient oil fuel can be carried for the round trip and, in addition, 1,500 tons for the use of the *Leviathan*. The latter ship is now obliged to bunker 3,000 tons at Southampton on each voyage. Running in conjunction with the two reconditioned vessels on a 3 weeks' schedule the oil could be supplied to her at a net saving of over $200,000 a year. Furthermore on account of the very large amount of fuel carried and the possibility of replacing this with water ballast on the return voyage, the stability conditions which, as the ships are now arranged, are unsatisfactory would be vastly improved; in fact completely under control at all times.

It is proposed to arrange the passenger quarters entirely anew, with unusually large staterooms and, in the first cabin, every room provided with a connecting private bath. Owing to the low cost of reconditioning as compared with that of a new vessel, it will be possible to sell this very superior accommodation at relatively low rates and thus ensure a full share of passengers at all times.

Incidentally the reconditioned ships will be by far the finest in appearance of any on the Atlantic. The four

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present funnels will be replaced by two, widely spaced large ones, and as it will not be necessary to pile up quarters amidships, a peculiarity of most modern ships, the result is a fine and rakish ship reminding one of *Campania* and *Lucania* and others of the beautiful "greyhounds" which traversed the ocean 30 years ago.

The cost of carrying out this proposed reconditioning is estimated at approximately $6,000,000 for each vessel, much more than if the present machinery were to be retained, but a figure which apparently spells the difference between failure and success. The combination of circumstances which makes possible the scheme which has been outlined is most unusual; to those responsible for the maintenance of the United States Lines during the coming five or six years, it is nothing short of providential. We can only trust that its true significance will be fully realized and that this unique opportunity of doing a really great constructive work will not be allowed to pass into the discard.

It is quite true that under ordinary circumstances, it is a doubtful expedient to spend large sums of money on old vessels. The present instance is anything but ordinary; more vessels are, or shortly will be, imperatively needed. The proposal is the only one put forward which will meet the situation with ships which can be economically operated and give any promise of a return on the money invested in them.

Steam Colliers

THERE has recently appeared in the *Liverpool Journal of Commerce* an interesting series of articles relating to the loss at sea, due to stress of weather, of certain small coal carrying steamers. While the ships concerned were all much smaller than the average American collier, plying on the Atlantic coast, the similarity of type to the very large number of vessels in our coastal coal trade makes these articles of particular interest to American readers.

It appears that in practically every instance the loss of these vessels was primarily due to the failure of their wooden hatch covers and the hatch tarpaulins and fastenings although bad seagoing trim and insufficient areas of freeing ports were contributing causes. The writer discusses at length the design of the vessels, their arrangement of superstructures, hatch trunks and wells, as affecting their seaworthiness but to one familiar with the American type of vessel it is rather surprising that the design of the hatch covers themselves is not dwelt upon at more length.

It is true that the necessity of heavy tarpaulins and efficient fastening devices for the hatch covers is emphasized: it was the lack of these that was the eventual cause of the vessels' foundering but we noticed no mention of the solid hinged covers of steel which are in common use on American steamers of this type. In winter service on the Atlantic coast the latter ships often encounter weather quite as severe as is ever found in the English Channel or the North Sea and when deep loaded heavy seas are continuously breaking on deck and completely flooding the spaces, they can hardly be termed wells, between poop, bridge and forecastle yet we have never heard of one of these ships being lost through failure of her steel hatch covers. They are apparently as immune from damage of this sort as the average oil tanker.

It would seem that many, if not most, of such founderings as the British writer has described might have been prevented by the use of solid steel hatch covers.

From Model to Ship

AT various times occasion has been taken in these pages to mention certain gaps which exist in the science of naval architecture; twilight zones, as it were, surrounded by areas illuminated with the light of relatively definite knowledge. As time has gone on and knowledge has grown the width of these shadowy "no man's lands" has steadily decreased; in some instances they have virtually disappeared and the regions once separated are in direct working contact. Others still remain, but workers on each side of the gap are steadily reducing its width and bringing nearer the time when uncertainty will give place to fact.

Such gaps exist in every form of operative engineering work, for practical engineering is far from being an exact science. It is here that experience steps in to guide the engineers in building the bridge from one area of knowledge to the other. But experience gained in one field of investigation may lead in quite different direction from that derived in the other and the two ends of the bridge will not quite meet at the center; the key truss will not fit in place. In such case the obvious inference is that one end of the bridge, possibly both, was not started in just the right direction; it is "up to" the engineers on each side to prove their cases.

Ever since the elder Froude's historic experiments on the *Grayhound* cleared the way to the application of the Law of Comparison to the powering of ships it has been quite fully recognized that the results obtained were rarely, if ever, mathematically exact. In view of the general complexity of the problem and owing to the fact that, except in ships of relatively high speed, by far the larger portion of the total resistance does not follow the law of comparison but has to be calculated by more or less empirical methods, it is perhaps not surprising that exact agreement of theory and practice is not arrived at—is, in fact, not to be expected.

For high powered vessels the model tank has come to be very generally considered an accurate prophet of what may be expected in the full sized ship but even in their case absolute accuracy seems impossible of attainment and the discrepancies which not infrequently occur in the power required to drive what are presumably duplicate ships at the same speed has, in the minds of some, cast a shadow of doubt upon the accuracy of the model tank method. On the other hand, Froude's theory is fundamentally sound and the methods of the tank partake of laboratory accuracy, quite uninfluenced by the many foreign and disturbing elements present in practically all full sized ship trials.

The situation is such that what might be termed two schools of thought, as applied to the powering of vessels,

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have sprung into existence. On the one hand stands the model tank operator with pretty positive knowledge as to the actual resistance of his model and what appears to him a well founded belief in the accuracy of his method of applying the model results to the full sized ship, while on the other we have the ship operator who contends that the actual relation of speed and power can be determined only from the ship and that the variations developed as between ship and ship are due to physical causes impossible of accurate reproduction in the model—in other words, that the ship trial and not the model experiment forms the true basis of comparison and for future power calculations for similar vessels.

There is a good deal to be said on each side of the question but to an outside observer it must appear that after both contestants have exhausted their arguments *some* debatable ground must, of necessity, be left uncovered; a small gap of uncertainty must still remain. The powering of a ship may closely follow the methods of the physical laboratory but it cannot, in reason, be expected to attain its degree of accuracy. The conditions affecting the performance of the ship are too complex and too variable to admit of positive analysis and there are certain points of dissimilarity between the model and the ship which, in practice, cannot be entirely eliminated. Some discrepancies must remain and it is the business of both the experimenter in the tank and the operator on the ship to reduce them to the smallest possible amount.

An admirable illustration of the present situation as regards powering relatively high speed vessels is to be found in Captain McEntee's paper on the standardization trials of the battleships *West Virginia, Colorado* and *Maryland,* read before the Society of Naval Architects and Marine Engineers last November.*

These vessels were built from the same lines, two of them by one builder and the third at another shipyard. Their underwater forms are intended to be identical and the propellers fitted to all three are the same except as regards diameter which was reduced somewhat in the inboard propellers of two of the ships. Results from a single self-propelled model were used in fixing the designed revolutions and powers of all three ships.

The trial results of one ship, the *Maryland,* agree closely with the model data. On the presumption that the power measurement for this ship was correct those for the *West Virginia* and *Colorado* were respectively 4.2 percent and 8.3 percent too high. Captain McEntee concludes that "the result of the whole comparison would probably warrant the conclusion that for relatively low powered ships, at least, the power required for their propulsion can be estimated from self propelled model tests with greater accuracy than the power can at present be measured on the full sized ship during her trials." A very similar view was expressed in Dr. Telfer's recent contribution to the North East Coast Institution of Engineers and Ship Builders, which stated: "Every speed and power curve obtained is largely accidental and a vessel will generally have as many such curves as she has load trials."

* See *Marine Engineering and Shipping Age* for December, 1926.

Captain McEntee's statement, as was to be expected, immediately drew the fire of the "trial trip party"—we trust we may be pardoned for intruding a political term in a scientific discussion, but it seems to fit. It was claimed that the electrical power measurements (all three ships have electric drive) closely checked the torsion meter readings and that the apparent discrepancies in power could be accounted for by variations in displacement and unavoidable differences, both as regards appendages and condition of surface, between ship and model. Moreover, it was stated that the actual service performances of the three vessels, as indicated by their respective fuel consumptions, distinctly bears out the trial power returns. Had the *Maryland* alone been tried, the results would have been taken without much doubt as a direct substantiation of the model figures, but as the trials of the other vessels were conducted with equal care by the same officials one hesitates in questioning their accuracy; there well may be actual but hitherto unsuspected differences between their hulls or the condition of their hulls at the time of trial which would account for the differences in power developed. Certain it is that if the ordinary methods of shipbuilding produced hulls which differ sufficiently to cause a variation in power of 6 or 8 percent, then no method of power calculation can be depended upon to give results of greater accuracy than this for any specific vessel. We do not believe this to be the case; it seems more probable that as not infrequently happens both sides are partially in the right, but in the present instance the weight of the evidence appears to lie with the model tank.

Dr. Telfer's remark referred to commercial trials of slow speed vessels. Here there can be little question but that the burden of proof rests on the trial trip. Unless commercial trials can be conducted with something of the care and searching thoroughness devoted to naval vessels they can furnish little or no conclusive data as to the accuracy of model experiments.

Welding in Shipbuilding

DURING recent years the use of welding in ship repair work has advanced to such a degree that its successful application in this class of work has become a commonplace activity in the shipyards. No longer looked upon as a novelty it has ceased to attract the attention which it received in the early days of its development when each new job accomplished by welding drew forth the inevitable storm of praise and criticism which is aroused by an unusual or spectacular feat. On the contrary, the recognized acceptance of welding as one of the most useful and valuable methods of doing certain work in the shipyards today, because of the savings in time and cost which it makes possible, has established a sound basis from which further developments in the application of welding to shipbuilding as well as ship repairing may be expected.

As a matter of fact new applications of welding in ship construction are being made every day at the yards of the Newport News Shipbuilding and Dry Dock Company under the able direction of Mr. James W. Owens, director of

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welding at this yard and a recognized authority on the subject in this country. A striking example of this is found in the Coast Guard cutter *Northland* which this company is building to replace the historic cutter *Bear* in the Bering Sea patrol. In the construction of this sturdy ship, which is designed to withstand the rigors of continuous service in the Arctic ice floes, metal arc, gas and thermit welding have been used more extensively than in any ship of its size constructed in the world to date. The seams and butts of its decks and superstructure were very largely metal arc welded instead of being joined in the usual manner by riveting. The seams of four strakes of side plating at the water line of the hull, where extraordinary strength and stiffness are needed to resist ice pressure, were riveted in the usual manner, but the edges of the laps of these seams were reinforced and made watertight by a 5/8-inch continuous fillet weld. The rudder was constructed by having the 5/8-inch plating metal arc welded to the cast steel frame. As the rudder weighs 4½ tons it is believed to be the largest welded rudder constructed to date. The stern frame was constructed in two parts and joined by thermit welding. Although many stern frames have been repaired by thermit welding, this is the first time thermit welding has been used in constructing a new stern frame, and it points the way for new construction in the future, particularly for wrought steel frames. Another new application of welding in the construction of this vessel was developed in constructing a heavy brass bulwark rail around the stern where the sections of the rail were joined by gas welding. In addition to the foregoing, all of the tanks not a part of the hull structure were metal arc welded.

Another interesting application of welding in shipbuilding was carried out recently at the Norfolk Navy Yard where a pontoon for a 120-ton derrick was built in which the shell, deck and two bulkheads were welded. The results of this have been so satisfactory that it is reported that in the event of building another similar pontoon all of the seams would in all probability be completely welded. Furthermore in the modernization of several battleships now under way in various Navy Yards, the extensive use of welding, it is estimated, will result in a saving of $250,000 for each ship. Again, the Navy is using welding extensively in the construction of its new cruisers with the object of making substantial savings in weight.

In the construction of merchant vessels at the Newport News yard a large proportion of all oil, gasoline, fresh and salt water tanks, together with their piping systems, are now being welded and steps are being taken towards the complete welding of all ventilating ducts. During the past year the metal arc welding force at the yard has been increased from 25 to 65 and a school for the training of welders to supply the demands of the company has been established. The Newport News Company is also extending the use of welding in its other classes of work, such as hydraulic work, steel building structures and the like.

The above instances serve to emphasize the advantages to be derived from a more extensive use of welding in shipbuilding. It is apparent that care must be exercised in the selection of equipment, methods and men for doing the work. Intelligent training of the welders and competent supervision of their work are essential for successful results. Like all other practical developments in the metal working industries actual savings over previous methods combined with the reliability which experience alone can guarantee are the chief incentives in the growth of welding as applied to shipbuilding. That recent developments along this line are justified by the results appears obvious and it is to be hoped that the development work now under way may open up new applications for this relatively new method of steel construction.

The Shipbuilding Situation

ORDERS for new tonnage placed with shipbuilders in the United States during the first three months of this year have been insufficient in either numbers or volume to lend any encouragement to the immediate outlook for the shipbuilding industry. Except for two large oil tankers, the orders so far received comprise only small vessels of special types for domestic uses and, with the failure of the last session of the Congress to take any action in support of merchant shipping, the situation remains unchanged with respect to the building of new vessels for overseas service or the replacement of old tonnage.

How critical this situation is can be judged from the statements made by Captain R. D. Gatewood, manager of the Maintenance and Repair Department of the Shipping Board, in an address on "Sea Power and American Destiny" broadcasted from New York last month. We are not building a single hull for foreign trade, he said. The very few vessels we are building are for our coastwise trade. The condition of our shipyards is pitiable. Most of them have gone out of existence and the very few left have only skeleton forces of draftsmen and mechanics and have made virtually no renewals of shop tools or equipment for over 5 years.

If this situation continues, it will be only a matter of months, according to Captain Gatewood, before more yards will close their doors so that when we do decide to build ships, as we inevitably must, we will lack not only the mechanical equipment for doing so but also, what is equally, if not more, important, the organizations of skilled men trained to do this work. The ships of the future will be larger and faster vessels than those of our war-time-built fleet and will require far more skill for their design and construction. As every one connected with shipping knows, it requires years to build up an organization of men trained to do this work efficiently and economically. In the face of this necessity the shipbuilding industry has been steadily losing its trained men and the exodus is continuing daily.

Captain Gatewood's viewpoint is that of the trained naval constructor whose life has been spent in the actual building or repair of both naval and merchant vessels. His views as to the gravity of the present situation are shared by scores of other trained men in the shipbuilding industry. The pity of it is that the general public and their representatives in the Government fail to grasp the fact that in the entire history of the nation sea power has played the decisive part in our destiny and that our strength at sea under present conditions is dependent very largely upon our merchant shipping.

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The Key System ferry boat Peralta on her trial trip

Key System Ferry Boats Peralta and Yerba Buena

Delivery of the first of two new turbo-electric vessels for service on San Francisco Bay marks the appearance of an inland passenger ferry de luxe

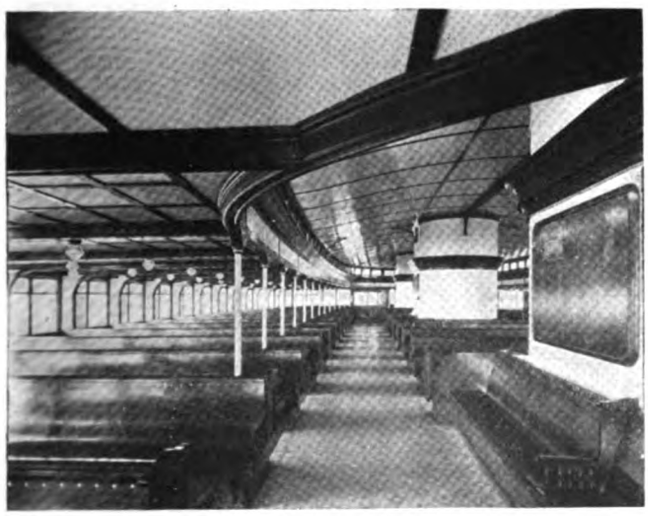
By S. Burke Smith*

TRANSPORTATION of passengers across San Francisco Bay has become a highly competitive business—a business whose charges are regulated by a State Railroad Commission and whose bid for public patronage must be based solely upon service offered. For the purpose of giving better service to the public as regards speed and comfort, without sacrificing safety, reliability or economy, the *Peralta* and *Yerba Buena* were designed and built. The *Peralta* has just been delivered by her builders, the Moore Dry Dock Company, Oakland, Calif., to her owners, the Key System Transit Company, San Francisco, Calif. The *Yerba Buena* will be delivered from the same builders next month.

The following are the characteristics of the vessels. An account of the trials, on which all guarantees of speed, horsepower, fuel consumption and metacentric height were exceeded by handsome margins, will appear in a later issue.

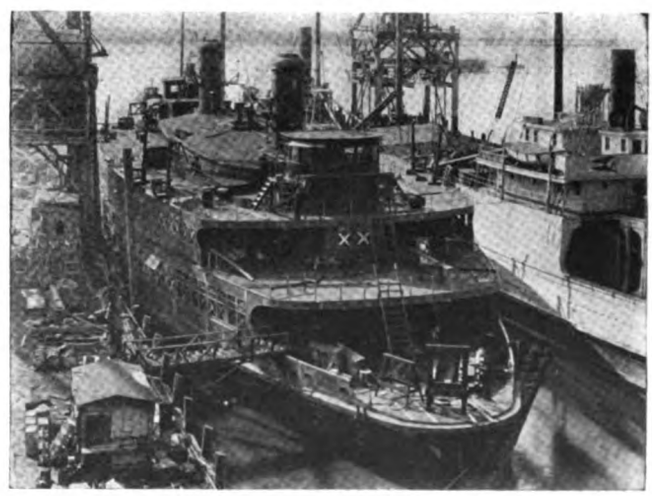
Length over all	276 feet
Length between rudder posts	256 feet
Length between perpendiculars	256 feet
Breadth over guards	70 feet
Breadth molded at sponsons	47 feet

*Member of the firm of Hibbs, McCauley & Smith, naval architects and marine engineers, 311 California street, San Francisco, Calif., who designed and superintended the construction of these vessels.



View of upper passenger deck

Note the teak trough mouldings around the fidleys and the base of the dome which conceal the lights and reflectors that illuminate the dome. The paneled ceiling contains life preservers.



The Yerba Buena nearing completion at the yards of the Moore Dry Dock Company for the Key System Transit Company

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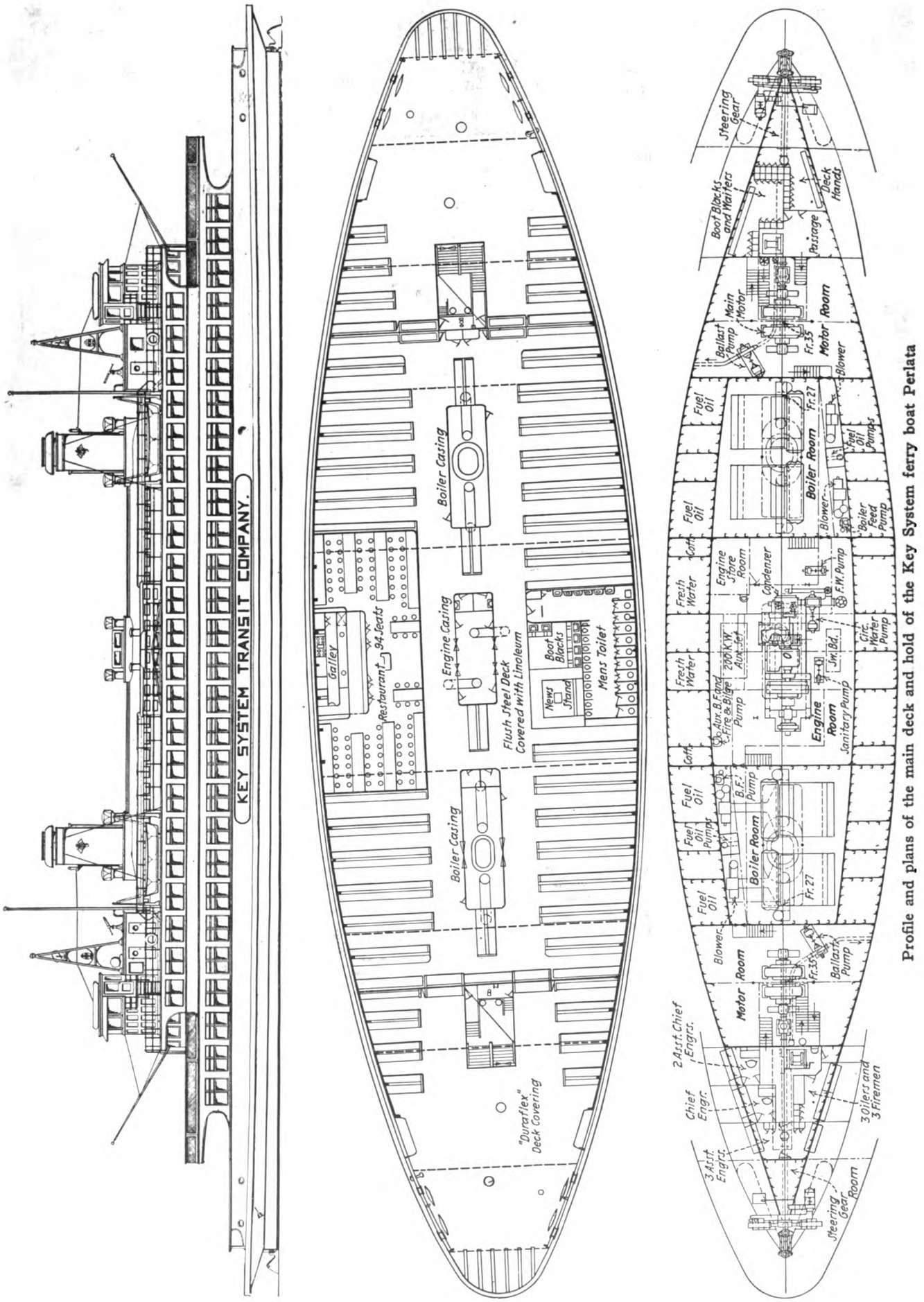

Profile and plans of the main deck and hold of the Key System ferry boat Perlata

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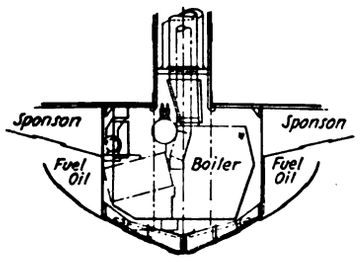
Depth of hold	18 feet 4 inches
Depth molded	21 feet
Sponson overhang	11 feet 6 inches
Normal light displacement	1,754 tons
Normal light draft—keel	13 feet 7½ inches
Normal load displacement	2,015 tons
Normal load draft—keel	14 feet 9½ inches
Deadweight capacity	261 tons
Passenger capacity	4,000
Seats	2,340
Normal shaft horsepower	2,250
Maximum shaft horsepower	2,600
Speed (Normal shaft horsepower, normal light displacement)	14.5 knots
Speed (Maximum shaft horsepower, normal light displacement)	15 knots
Propeller revolutions (normal shaft horsepower, normal light displacement)	200
Capacity, fuel oil	228 tons
Capacity, fresh water	153 tons
Capacity, stores	18 tons
Normal fuel oil, two-thirds	152 tons
Normal fresh water, two-thirds	102 tons
Normal stores, two-thirds	42 tons
Capacity, trimming tanks, each	60 tons

Complete specifications were prepared in advance of the call for bids, contract plans submitted both to the U. S. Steamboat Inspectors and to the American Bureau of Shipping, with whom the vessels are classed, and a model was run in the Ann Arbor model tank. A summary of weight and stability calculations, model tank data, specifications for the vessel, contract plans, predicted speed—horsepower—revolution curves, and a form of contract to be signed by the successful bidder, all were enclosed in the letter to the respective shipyards transmitting the invitation to bid.

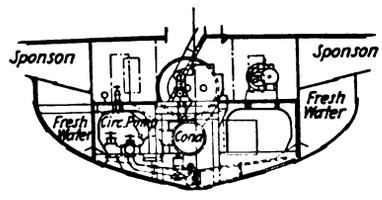
In order to avoid a division of responsibility, the contract was drawn with the shipbuilder so as to cover the complete ship. The bidding shipyards each submitted separate proposals in order to cover the separate types and characteristics of turbines, generators and main motors.

Shortly after the public opening of the sealed bids, the owner designated the type and manufacturer of his main propelling machinery, after which the contract for the complete ship was signed with the successful bidder. This unification of responsibility in the person of the shipbuilder has resulted most satisfactorily.

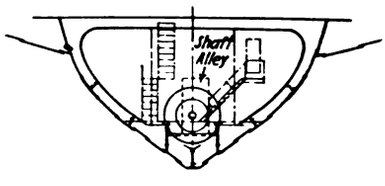
Guarantees as to performance (which the yard under the contract was required to assume) were purposely written low so that the yard would feel no reluctance in assuming them. No exception was taken to the guarantees by the bidders and, as stated above, predicted performance (in excess of guaranteed performance) was realized on trials.



Section at Fr. 27 through boiler room



Section amidships through engine room

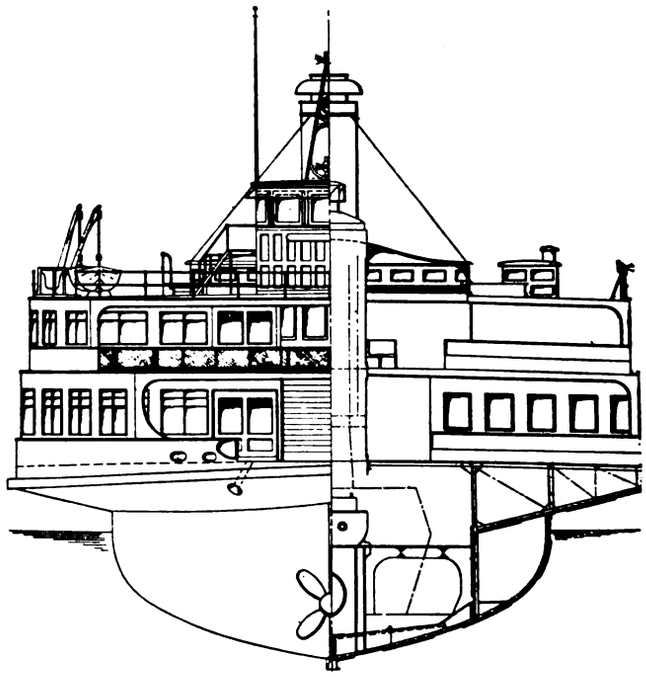


Section at Fr. 35 through motor room

HULL CONSTRUCTION

The hull and topsides are of steel. The wood actually on board has been reduced to the minimum requirements of pilot houses, benches and moldings. Coefficients were selected and lines drawn so as to arrive at a hull that would be easy to drive. Although 25 percent greater in displacement than her predecessors on this run, and possessing over 2 knots greater speed, the *Peralta* will maintain the smaller boats' speed and schedule on a lower fuel consumption.

A duct keel of 12-inch channels and bottom plates was used. This was primarily to assist the captain in handling the vessel at the slip entrances. Both terminals are located in strong tideways which run athwart the slips, and the "crabbing" of previous boats had sorely tried the patience and seamanship of the captains. Actual landings in the slips in the course of the *Peralta's* trials showed that no "crabbing" will be encountered.



End elevation and section

The hull is divided by watertight athwartship bulkheads into the following compartments:

No. 1 Trimming tank.
No. 1 Motor room.
No. 1 Boiler room.
Engine room.
No. 2 Boiler room.
No. 2 Motor room.
No. 2 Trimming Tank.

The end compartments were fitted as trimming tanks in order to submerge the end of the boat some 6 inches and make sure of clearing an overhead arch that spans the end of one of the slips. At the time of highest tides and the roughest seas this 6 inches may save the name board, although at normal high tides the clearance is ample. This arch also dictated the use of the pyramidal angle mast abaft the pilot house as a mounting for the range light, fog light and searchlight. These would normally be mounted on top of the pilot house. Motor driven centrifugal pumps of high capacity will empty the trimming tanks in 3 minutes.

In addition to the athwartship watertight bulkheads mentioned above, there are 2 longitudinal watertight bulkheads that extend from motor room No. 1 to motor room No. 2. These add longitudinal strength and stiffness to the hull,

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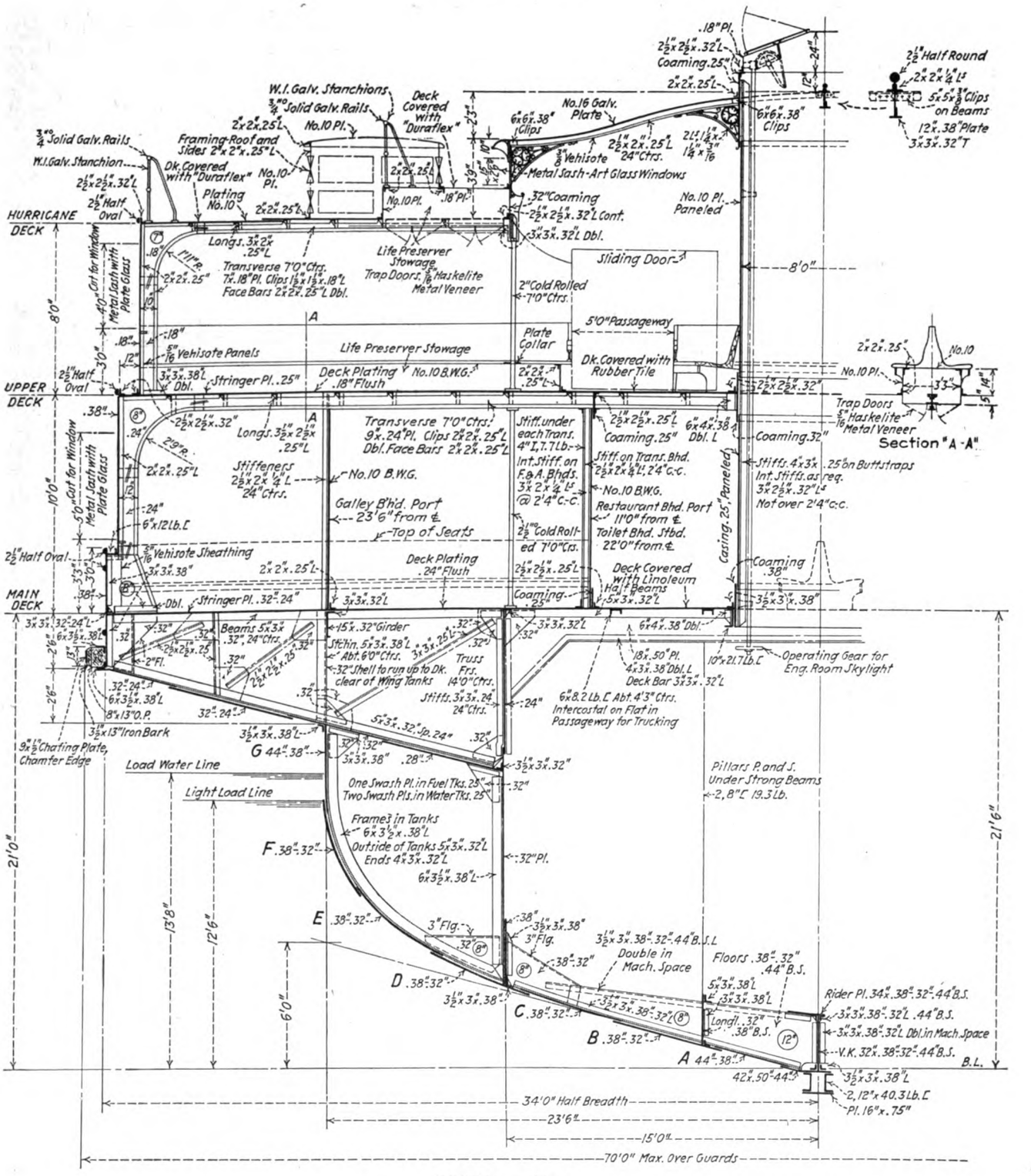

Midship section

permit the absence of center line stanchions in the hull compartments, provide fuel and fresh water storage facilities and, in connection with the plated-in, watertight sponsons, provide a factor of safety not otherwise ordinarily obtainable.

In the usual ferry boat construction the overhung main deck is supported by a row of stanchions. The *Peralta* class vessels are encircled by a watertight collar—a life ring, as it were—whose bottom plating is heeled on the longitudinal bulkhead amidships; it is itself subdivided by the watertight athwartship bulkheads. This sponson has sufficient buoyancy to float the ship with every sub-deck compartment flooded and, owing to the enormous increase in water plane area, the vessel so supported will float upright. Furthermore, the sponson absolutely limits the angle of list or trim the vessel can take, thus ensuring that she will not capsize, even when sorely wounded.

An external view of the boat shows, in addition to the sponsons, 2 symmetrically placed stacks on the fore and aft line, the pyramid masts mentioned previously, life boats on the hurricane deck and the cantilever method of supporting the upper deck. The location of the boiler

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rooms, which dictated the stack locations, will be referred to later.

Life boats were placed on the hurricane deck in order to give more space and vision for the main deck passengers and also to enable the crew to lower the boats without interference of passengers.

It need not be said that their location meets with the approval of the U. S. Steamboat Inspectors. On account of the popularity of the Bay ferries with persons contemplating suicide, the "man overboard" hail is frequently heard, and a system of distinctive electric bells with numerous push buttoms is indicated as the "Suicide Circuit" on the wiring diagram and the name plates are so labeled.

The unloading and loading of a capacity crowd has been given thought, one of the results of which are the cantilever supports of the upper decks at the ends of the vessels. These eliminate the necessity for the stanchions. Offsetting the capstan and placing the anchor windlass below deck have also aided in making the flow of traffic over the ends of the main deck easy and unobstructed.

The anchor, a stockless anchor, houses in a hawse pipe let into the sponson. There is one anchor at each end of the boat.

Life preservers for the main deck are stowed in trunks built under the benches of the upper deck; hinged doors tripped by chains, release the preservers from the lockers. For the upper deck the life preservers are stowed in overhead trunks formed by runways that connect the two pilot houses. In the case of both decks, the locker doors are flush with the overhead panels, and the absence of the usual slatted pine lockers and toggles is both pleasing and space conserving.

Comfort of the Passengers a Special Consideration

A description of the features of the *Peralta* class that add to the comfort of the passengers should begin properly with the choice of the propelling machinery. The *Hayward* class—the most recent additions to the Key fleet preceding the *Peralta* and *Yerba Buena*—with their lack of vibration had established themselves definitely in the minds of the travelling public. It is an actual fact that one can board either of those vessels, sit down, begin reading, and, unless the eye be taken from the page, one is unaware that the boat has left the slip. Compared to the rhythmic vibration of reciprocating engines, either in conjunction with paddle wheels or not, the contrast is most pleasing. And so one of the deciding factors in the choice of turbo-electric drive was the desire to maintain the high standard of comfort already established in the minds of its patrons by the Key System. This was a matter of executive policy, not of engineering.

The comfort and pleasure of the passenger begins at the boarding apron; he steps on the boat and is not jostled against capstan or stanchions. The popularity of the spaces outside the cabins of the old boats is responsible for an increase in length (enclosed on the sides by plate glass windows) of 35 feet on each end. Comfortable benches are provided here for those who desire to enjoy the pleasure of the trip in the open air.

The lower deck is the smoking deck. Its head room has been increased 1 foot. The general finish is unglossed white with varnished teak trim and benches. Brown battleship linoleum covers the steel deck (which has been insulated in the boiler rooms)—brown linoleum with two narrow parallel borders of black and white.

The benches are built of teak frames, with the ends of attractive designs. A walnut laminated veneer, molded to a template, forms the seats and backs. The frames and veneer have been stained and varnished to harmonize. The shape of the seat and back received considerable thought, and the model finally selected was the one of four submitted which received practically unanimous endorsement from scores of persons whose opinions were invited. There is a support for the small of the back that is unexpected and very pleasing. Metal trunks occupy the spaces underneath the benches; in a way these add to the comfort of the public in that they materially reduce the time required for the deck hands to clean up the deck—an operation required at frequent intervals.

Large plate glass windows in one piece are installed in metal sashes that are bent to the contour of the cabin. Superimposed above the main panes are ventilating panes so designed as to keep out all except a horizontal drive of rain and at the same time ensuring the inlet of a large and ample quantity of fresh air.

On each side of the boiler fidleys (of which there are two) are grill covered ventilators which open into the smoke stack air jacket. On trials the draft was sufficiently strong through these vents to cause a pocket handkerchief to stick to the grills. These will serve to clear away much of the smoke of the smoker.

Outboard on the main deck on one side is the men's lavatory; in the corresponding location on the other side is the restaurant and galley. Lavatory ventilation is supplied by the ventilating panels of glass, by two trunk ventilators from the hurricane deck and by two ducts which connect to the smoke stack air jacket. The deck in the lavatory is of red square tile bounded by white gutterways. The gutterways are so sloped and the scuppers are so located as to permit the whole compartment to be flushed out with a hose.

The news stand and bootblack stand are situated in a convenient location off the midship line on the main deck.

The Restaurant

The restaurant is outboard amidships on the main deck. Attractive lighting fixtures, window curtains and artistic floor tile give it a bright attractive appearance. The white glossy table tops with curved rims, and chairs with cane inserts in the seats and backs add to its sanitary aspect and promise of comfort. Apparatus has been arranged so that the attendants can serve their respective tables without crossing the center line of the compartment; for this purpose ice cream cabinets and milk and cream cabinets (both served by mechanical refrigerator), coffee urns, ice water faucets, etc., are in duplicate, one for each section of the restaurant.

The built-in galley equipment is of monel metal, nickel trimmed. The hood over the steam tables is vented by an induced draft. Ample hot and cold fresh water are piped to convenient locations and a store room in the sponson directly underneath the galley will supply space for non-perishable stores and stowage for portable outfit.

At one time the suggestion of putting the restaurant and galley on the hurricane deck, to be reached by an escalator, received serious consideration. Here again the habits of the genus commuter influenced the owner to such an extent as to cause the restaurant to be located in the same relative position as on the older boats. The restaurant does an immense business—figures showing that breakfasts are supplied at the rate of 2⅔ persons per stool during the morning rush trips on the older boats. The new boats will seat 94 persons at a time in the restaurant, an increase of some 20 percent in capacity. The popularity of the Key restaurants is attributed in a large measure to their locations above deck, where fresh air, light and scenery can be enjoyed at meal time.

The main entrance doors to the cabins on both decks are solid wood, sheathed with copper which will be maintained varnished and lacquered.

The lights in the passenger spaces proper are of sufficient wattage and numbers to ensure a candle-footage 2½ feet

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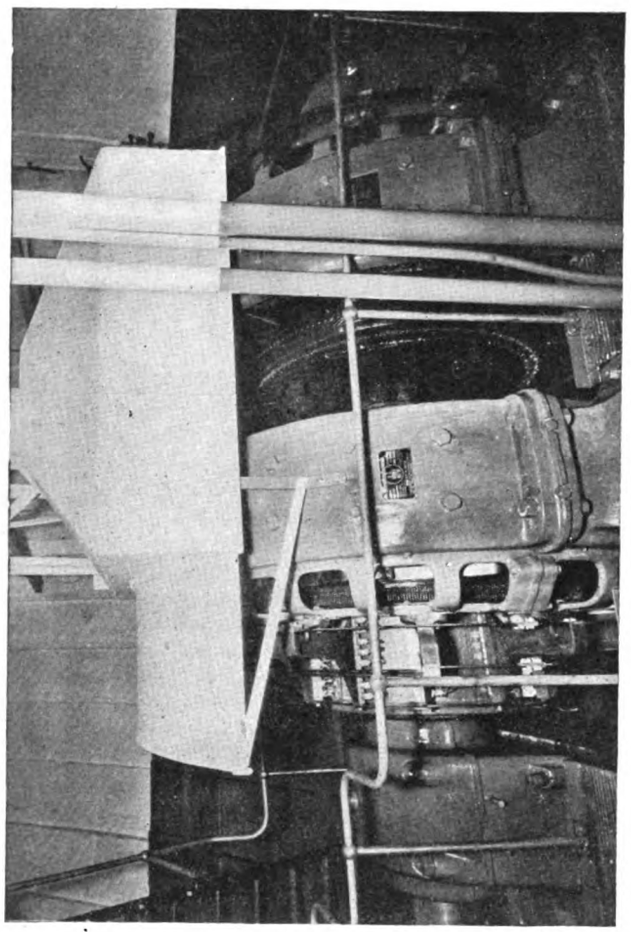
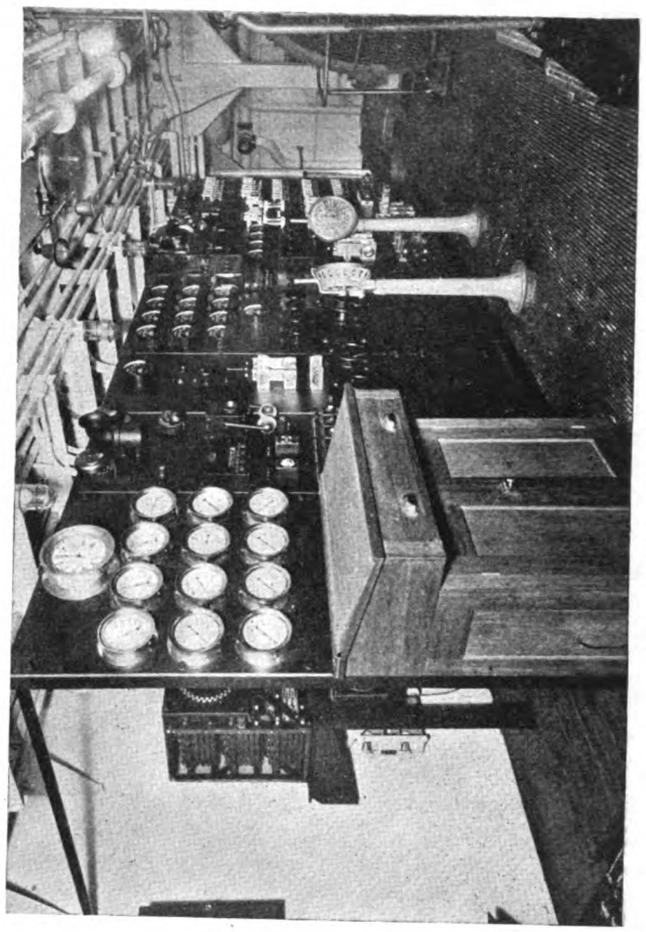
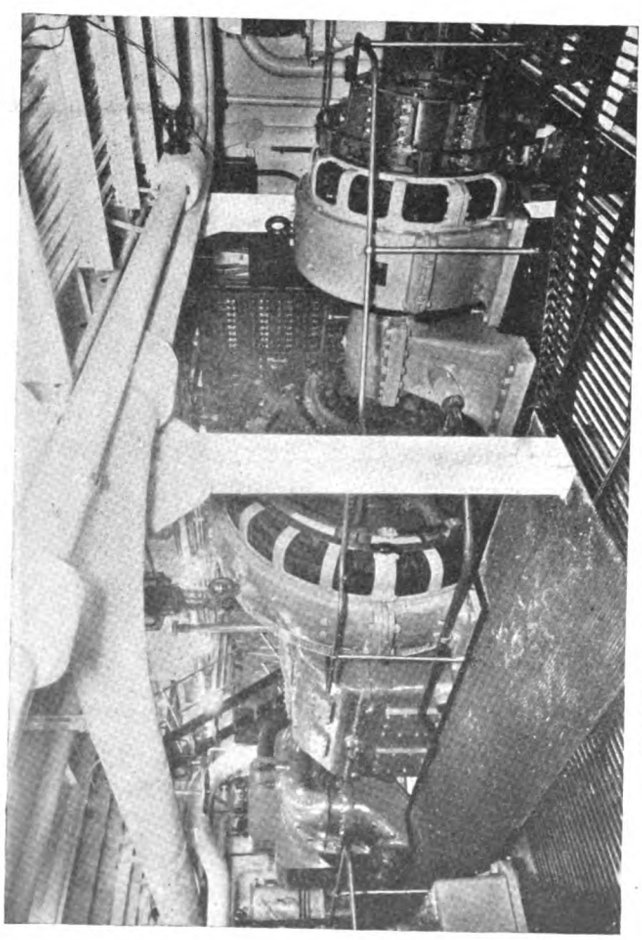


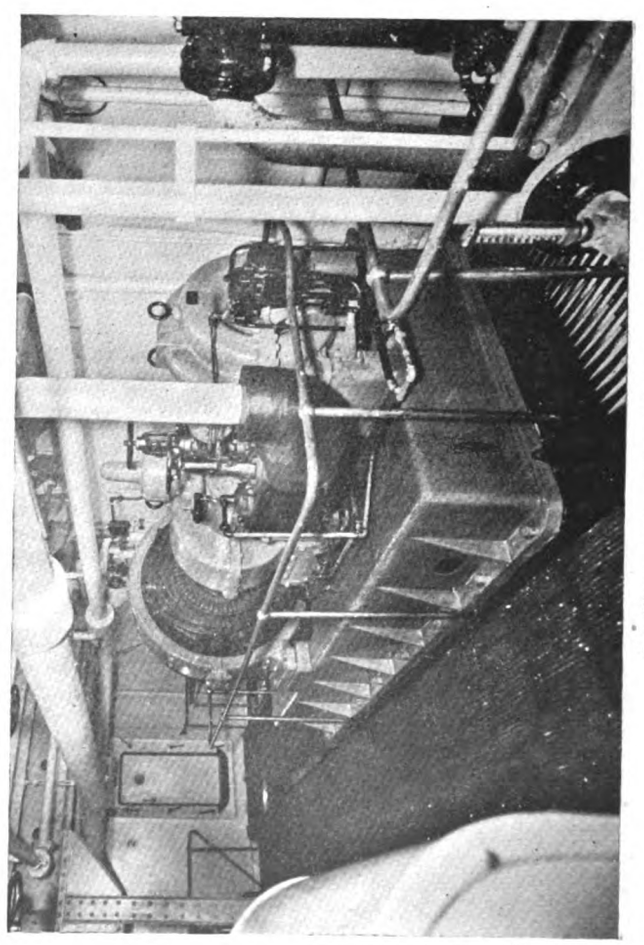
Double armature main motor



Main switchboard and gage board



Main turbine, reduction gear, generator and exciter



Auxiliary turbo generating set

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above the deck in excess of that actually recommended by the authorities in such matters. This means that every passenger will have a well illuminated page to read when travelling at night. Special fixtures of artistic beauty are provided not only in the restaurant but in the ladies' rest room on the upper deck, and in the board of directors' room on the hurricane deck. Fixtures in the main spaces are modern and scientifically correct.

On the upper deck the floor covering is of interlocking rubber tile in attractive patterns and shades. Two clocks electrically operated as repeaters will give the patron the correct time. A large dome, lighted at night by concealed fixtures, reflects on its white surface in the daytime the colors of the stained glass dome windows. Six oil paintings are mounted on the six fidleys—one on each side of each fidley; these deal with local geographical features in a very attractive and highly artistic manner.

In addition to the usual arrangements in the ladies' rest room, there is a separate ladies' rest room containing a writing desk, smoking facilities, dressing tables and mirrors, comfortable leather upholstered chairs and davenports.

There is a room on the hurricane deck, called the board of directors' room, equipped with leather upholstered chairs, a desk, basin and water and a first aid outfit. In case of illness or accident, the patient, if necessary or desirable, can be taken care of in this room, away from the other passengers.

Running ice water cooled from the duplicate sets of electrical machines is piped to both decks.

Propelling Machinery

The direct current, turbo-electric form of power plant was selected by the owner as the result of careful consideration of all matters that bore on the subject. The Key System fleet dates from 1905, and all the boats are screw propelled. There are no shoals to be avoided on the run, and draft is not a controlling factor. Maneuverability is of great importance, and it was decided that the new boats should be of the screw propelled type. Furthermore, the economy and flexibility of control to be derived from the use of separately driven bow and stern propellers dictated the use of electric drive. In order to enjoy the maximum advantages of flexibility, direct current was decided upon instead of alternating current. The next question became that of the generator prime mover—whether it should be turbine or Diesel. In order to understand the owner's decision, the following items must be considered briefly:

First. The records of the turbo-electric ferries *Hayward* and *San Leandro*.

Second. The desirability, if possible, of being able to shift crews (deck and engineers) from one boat of the fleet to another without reference to the license of the engineer.

Third. The vibration of the Diesel boat as compared with that of the turbine.

The *Hayward* and *San Leandro*, after the usual "kinks" had been ironed out, certainly showed a satisfactory performance sheet based on reliability and economy. Their "out of running time" had been practically nil, and the all around behavior of their direct current turbo-electric plant had been quite impressive. Each boat requires three complete operating crews; this furnished at once a nucleus of trained personnel for the new boats, should the same type of propulsion be chosen. Moreover, it insured continued interchangeability of operating personnel. At the time of the decision, the fleet consisted of six boats; four of them were reciprocating engine, steam driven, while two were turbo electric. To have introduced two new boats with Diesel electric drive would have been adding to the heterogeneity and would have introduced serious problems for the operating department. Finally, such local demonstrations as were available showed the Diesel boats to be great vibrators. Many of the causes of such vibration were distinctly not inherent in the Diesel itself; but it cannot be denied that, per se, the reciprocating machine does set up more vibrations than does the rotating one. This bore directly on the comfort of passengers, upon whose satisfaction the profitable operation of the company depends. And so turbo-electric drive was chosen.

The normal speed of the boat was based upon the owner's desire that the new boats make the trip from slip to slip in a certain number of minutes and seconds. It was therefore necessary to study such items as the time required to get up to full speed after leaving the slip; the influence of a two-point change of course in rounding Yerba Buena Island; and the custom regarding slowing, stopping, backing, etc., in entering the slip. In addition to the normal speed thus arrived at, the owner desired a margin which would permit the boats to make up lost time caused by possible lateness of the connecting train service.

Boilers

Speed, and corresponding horsepower, having been arrived at and checked by model tank runs, it was decided to divide the total required heating surface into four units and put two units in each of the two fire rooms. There were a number of reasons for this subdivision and location. In the first place, it appeared desirable to be able to overhaul a boiler without withdrawing the ship from the run; secondary that in case of casualty to one fire room the other be not affected. The selection of four Babcock & Wilcox watertube boilers with interdeck superheaters, with a total heating surface of 11,348 square feet, permitted the above desirable features to be realized. The 2,250 shaft horsepower speed and endurance trials were run with three boilers. The use of two fire rooms affords a straight draft line between uptake and stack and the use of two-stacks completes the symmetry of the boat's external appearance.

Steam at 265 pounds per square inch pressure and 100 degrees superheat is supplied; 38,750 pounds per hour are guaranteed with a draft at the furnace fronts not to exceed 0.28 inch of water.

The oil burners are of the Babcock & Wilcox mechanical atomization type. The automatic control of the oil fuel to the burners is effected by the Merit system. This is based on the steam pressure and is sufficiently sensitive to maintain the steam pressure within 5 pounds of a setting; it not only controls fuel to the burners but also operates an assisted draft blower and dampers. Owing to the wide fluctuation in demands on the boiler plant, this automatic control of fuel and draft is essential.

Superheaters of the interdeck type were selected primarily on account of the space available on top of boilers; the superimposed superheater would have necessarily been located too close to the main deck. As stated elsewhere, the under side of the main deck in the boiler rooms is insulated.

Main Turbine

The main turbine is of the Westinghouse single-flow combined impulse and reaction type, designed to operate on steam at 250 pounds gage pressure and 100 degrees F. superheat. The water rate guarantees are based upon the use of such steam and 28½ inches of vacuum referred to a 30-inch barometer.

The impulse element consists of two rows of moving and one row of stationary blades. The steam chest is located on top of the turbine cylinder and contains the admission valves, primary and secondary, which are under governor control. These valves are of the balanced poppet type and are fitted into renewable steel cases. The valve faces and seats are of monel metal.

The turbine governor depends for its operation upon oil pressure produced by an impeller mounted on the thrust

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end of the rotor. Inasmuch as this pressure varies as the square of the speed of the turbine, the governor is very sensitive to small changes in speed. In the event of a failure of the oil pressure, the turbine will be stopped automatically. The protective mechanism for shutting down the turbine in case of high over-speeds is located in the governor end of the rotor. In addition to these two safeguards, there is also provided a mechanism which closes the throttle valve in case the turbine rotor is displaced axially beyond a predetermined limit.

A vertical steam driven lubricating oil pump is so connected as to start automatically in case of a drop in the lubricating oil pressure system. Also, such a drop is called to the attention of the operator by means of a light and a bell.

Two lubricating oil coolers are provided, either of which will take care of the entire load.

The turbine operates at 3,600 revolutions per minute; the reduction gear of the floating frame type reduces these revolutions to 514, which is the speed of the main generator.

Reduction Gear

Power is transmitted from the turbine to the generator through a Westinghouse reduction gear, connection between the turbine shaft and the pinion shaft being made through a flexible coupling.

The bearings of the pinion shaft are carried in a frame separate from the gear housing structure which supports the bearings of the large gear wheel, this separate frame having a certain amount of freedom of movement which will permit the tooth pressure to become equalized along the entire face of the gears.

The gear housing and covers are strongly made of cast iron with an oil tight joint at the horizontal center line. All working parts are supported in the lower half of the housing and they are readily accessible when the cover is removed. Recesses for the gear bearing shells are machined in the housing and cover.

Forced lubrication is furnished to the gear and pinion bearings and to the gear teeth by the oiling system which supplies also the bearings of the turbine and generator.

All bolts and nuts inside the gear case are secured by means of lashing wire to prevent their working loose and possibly causing damage to the gear teeth.

The cover is provided with conveniently located hand holes for the inspection of the working parts.

A cast iron bed plate is provided on which is mounted the reduction gear, main generator field frame, main generator bearing and exciter field frame.

The bed plate is of sufficient rigidity to insure the permanent alinement of the apparatus mounted thereon.

Main Generator and Exciter

The main generator is designed to deliver 1,900 kilowatts at 600 volts, 514 revolutions per minute continuously, without exceeding a temperature rise of 40 degrees C. on any insulated winding. It will deliver 2,150 kilowatts at 514 revolutions per minute, continuously without exceeding a rise of 50 degrees C.

The generator is provided with compensated field windings and differential series field windings. Commutating field poles are provided and commutation is practically sparkless at all overloads as well as under normal conditions. The fields are separately excited at 115 volts.

The exciter armature is carried by the main generator shaft on an extension beyond the end bearing. It is rated at 200 kilowatts, 514 revolutions per minute, 125 volts, continuous, with a 40 degree C. temperature rise; for a 25 percent overload for two hours, the temperature rise will not exceed 55 degrees C. on the insulated windings.

The exciter is compound wound, and produces a compounding having a 5 percent drop in voltage from no load to full load. When operated in parallel with the 200-kilowatt auxiliary generator, these two machines will deliver constant voltage within 2 percent of 125 volts up to 1¼ load, and operate in parallel satisfactorily with the division of the load commercially even.

Propelling Motors

The main motors, two in number, are of the double armature type. They are designed for 600 volts; the revolutions per minute with a weak field vary from 200 to 212; with a strong field, from 148 to 160. The fields are shunt wound for separate 115-volts excitation. The main motors and the main generator are of the self-ventilating type.

Auxiliaries

The auxiliary generating unit consists of a Westinghouse single impulse turbine, a fixed bearing reduction gear, a generator and common bed plate. The set is rated at 200 kilowatts, 125 volts, continuous with a temperature rise not to exceed 40 degrees C. This capacity is more than sufficient to take care of the excitation of the main units and to furnish power for the electrically driven auxiliaries.

The turbine is supplied with steam at 250 pounds pressure and 100 degrees F. superheat. Its blades are of monel metal.

As stated above, connections for paralleling this machine with the exciter are provided. It is a Westinghouse unit.

The following auxiliaries and apparatus are electrically driven: Circulating pump, condensate pump, sanitary pump, fresh water pump, induced draft blowers, steering gear, trimming pumps, ventilating fans and lights.

The following are steam driven: Feed pumps, bilge pumps, auxiliary lubricating oil pumps and fire pump.

The circulating pump unit is of the horizontal, double suction, centrifugal type, complete with motor, bed plate and controller.

The circulating pump delivers 5,500 gallons per minute against a total head of 20 feet at 870 revolutions per minute and requires 46½ horsepower.

The condensate pump is of the centrifugal type with vertical shaft and forms with its driving motor a compact self-contained unit.

The pump casing and impeller are made of bronze. The shaft is of steel, protected from contact with water by a bronze sleeve extending through the stuffing box gland. A sleeve type coupling connects the pump shaft to the motor shaft, the whole of the rotating element being supported by a ball thrust bearing at the top of the motor frame. There are three shaft bearings, the two upper bearings being of the babbitt lined type lubricated by oil while the lower bearing, which is located close to the pump impeller, has a lining of lignum vitae blocks.

The pump has a capacity of 50,000 pounds per hour against an external head of 20 feet and requires 4.6 horsepower at 1,700 revolutions per minute. The suction opening is 5 inches in diameter and the discharge 3 inches. Its weight, with driving motor, is approximately 900 pounds.

The condensate pump motor is of the vertical type, provided with a canopy type hood for making the motor effectively drip-proof and at the same time allowing self ventilation. This motor is rated at 5 horsepower, 1,700 revolutions per minute at 115 volts, in accordance with A. I. E. E. standards.

The air ejector is of the double unit, multi-stage, condensing type, with intermediate and after condensers of the surface type. Either unit alone will handle the free air liberated under normal operating conditions.

Condenser

The condenser is of the two pass surface type. It is mounted directly below the main turbine. The tube plates and tubes are of Admiralty metal. The condenser shell

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is of mild steel plate. The water boxes are of cast iron. The cooling surface is 5,000 square feet. The vacuum guaranteed with 5,500 gallons per minute of 60-degree F. cooling water is 28.83 inches.

STEERING GEAR

There are two sets of steering gear identical in all respects, one at each end of the vessel. The arrangement is such that both rudders may be handled at any time from the pilot house, it being the intention to employ the bow rudder in conjunction with the bow propeller for steering when convenient or advantageous, particularly in making the slip, on account of the greater effort in swinging the bow as well as in stopping headway.

The steering gear is of the direct hydraulic type, with two athwartship rams, operating upon the tiller with a sliding crosshead. The rams and gear are installed within the sponson spaces somewhat similar to the stern of an ordinary ship but, in order to gain room and accessibility in the installation, the attachment of the steering gear is through a false tiller, side links and a yoke on the rudder head.

Hydraulic power is furnished by a motor-driven Waterbury pump, installed immediately at the location of the rams. The design and capacity of the entire gear are such as to handle the stern rudder from hard over to hard over—a total of 60 degrees—in 8 seconds' time, with the ship proceeding at full speed under the action of the stern propeller. Its power is also sufficient to put the bow rudder from hard over to hard over when (proceeding at full speed) the full propulsive power is transferred from the stern to the bow propeller.

The steering gear is of the Hyde type, including the hydraulic power unit, the rams and transmission to and including the false tiller and the entire telemotor control.

STERN AND THRUST BEARING

The stern bearings consist of babbitt-lined composition bushings, the babbitt being grooved for the circulation of oil. Abaft the outer bearing, the McNab-Vickers packing equipment is fitted. Both bearings are secured by studs and nuts through their flanges; taps are provided for installing draw bolts. An oil tank and connections for keeping the stern bearings under a head of lubricating oil are fitted.

A Kingsbury thrust bearing is fitted on each thrust shaft for absorbing the thrust of the screw and motor in both directions. Its lubrication system is self-contained except that its cooling coil is connected to engine room water service system, discharging into the bilge.

PROPELLERS

The propellers are of the three bladed, built-up type, of about 10 feet diameter, 8 feet pitch, and with a pitch area ratio of 30 percent. The blades are generally of elliptical shape, but modified so as to bring the area well toward the tips. The hubs are of cast steel and the blades of manganese bronze with steel studs and bronze cap nuts. The blades were finished to a sharp edge all around, machined, polished and balanced, after which the propeller was assembled and balanced.

Shop tests of the main power units (except the boilers) and the steering gear were conducted.

The two pilot houses each contain the following apparatus:

Bow rudder steering wheel, stern rudder steering wheel, bow rudder indicator, stern rudder indicator, master controller for main motors, No. 1 main motor ammeter, No. 2 main motor ammeter, No. 1 main motor electric revolution counter, No. 2 main motor electric revolution counter, engine room telegraph (emergency only), telephone, speaking tube, gong and jingle, whistle, bell pull and searchlight control lever.

Successful trial trips of the *Peralta* were run in San Francisco Bay, when the vessel maintained an average speed of 15.09 knots. This was more than half a knot in excess of the designed speed. Flexibility of control was demonstrated by bringing the ferry from full speed to a dead stop in approximately 30 seconds.

Southern Pacific's Diesel Ferries Nearly Ready

THE *Fresno*, one of the four Diesel-electric ferry boats under construction for the Southern Pacific Railroad, was recently launched and machinery is now being installed. The *Stockton*, another of the four, is nearly ready for launching and installation of machinery, while the *Tahoe* will probably be the third to go into service. All three are being built by the Bethlehem Shipbuilding Company of San Francisco. The fourth boat is being built by the General Engineering & Drydock Company.

This railroad, the owner of a large number of steam engine driven vessels including one of the largest ferries in the world, has up to this time had no experience with electric drive. Its decision to build the new ferry boats followed closely on the heels of the building of three Diesel-electric ferries for the Golden Gate Ferry Company and the service of the Diesel-electric tankers owned by the Standard Oil Company of California.

All the vessels are expected to be in service by spring or early summer. They will be operated in San Francisco Bay. They will be of the double-ended type, equipped with pilot house control, and will be used principally in vehicular service, although passengers will be carried.

The boats will be completely electrified with General Electric equipment. The main generating plant on each will consist of four Diesel engines built by the New London Ship and Engine Building Company of Groton, Conn. Each engine will be rated 450 brake horsepower at 230 revolutions per minute, and will be direct connected to a 275-kilowatt, 250-volt, direct current generator for supplying power to the propulsion motors, and a 40-kilowatt, 125-volt, direct current auxiliary generator. The auxiliary generator will not only supply excitation to the main generator and motors but will also furnish power for lights, ventilation and auxiliary equipment.

There will be two main propulsion motors on each boat, one at each end and each rated 1,250 shaft horsepower at 130 revolutions per minute. These motors will be so arranged that the speed of either may be varied over a wide range, thereby dividing the load between the bow and the stern motors at the will of the operator. The variable voltage system of control will be used, arranged for operation either from the pilot house or from the engine room.

These four ferries, with two additional boats now under construction for the Northwestern Pacific Railroad, will make a total of 69 Diesel-electric vessels in service or under construction, electrically equipped by various manufacturers, in this country. The first Diesel-electric ship was put in service in this country seven years ago.

Joints Sealed Against Oil Leaks by New Paint

A PAINT which is said to effectively seal joints against oil leaks has been developed by the General Electric Company and is sold by the Merchandise Department at Bridgeport, Conn. The product, known as G-E No. 880 Red Protective Paint, also prevents water and gas leaks. It can be used for many purposes which require red lead or white lead, and is less expensive than either.

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The paint, which is dark red in color, requires no priming and can be applied by brushing or dipping. Denatured alcohol is used as a thinner. It dries rapidly and produces a hard, smooth, glossy film which is easily cleaned and which prevents excessive collection of dirt and conducting material, thereby decreasing surface leakage and subsequent carbonization of the surface when used with electrical apparatus.

One of the first fields in which the paint has been applied is in the manufacture of fuel oil burners, in which one company is now using the material to seal all joints. Other fields in which there will be applications for the paint include plumbing, chemical plants, repair and service shops, packing houses, shipyards, central stations, electric railways, mines, and the manufacture of oil tanks, oil-burning locomotives and similar equipment.

Oil-Electric Tug Joins Long Island's Harbor Fleet

THE oil-electric tug *Meitowax,* built by the Staten Island Shipbuilding Company, Mariners Harbor, Staten Island, N. Y., went into service for the Long Island Railroad last month as a part of its harbor fleet. The vessel is 108 feet long, 26 feet beam and 12 feet 3 inches depth.

The power plant of the new tug consists of two 340 brake horsepower Ingersoll-Rand "PR" 6-cylinder, 4-cycle, 13 by 19-inch oil engines, each direct-connected to a 230-kilowatt Westinghouse compound-wound generator and 25-kilowatt exciter, which are non-reversing and operate at a constant speed of 265 revolutions a minute. The generators are connected in series and normally supply 480-volt direct-current for the 565 shaft horsepower double armature, shunt-wound Westinghouse propulsion motor. The oil engines operate on solid injection of fuel oil. All the engine room auxiliaries are driven by motors. The power is

New Long Island Railroad oil-electric tug

supplied, through the various switchboard combinations, by power takeoffs from the exciters.

A 6-horsepower Hill Diesel engine, driving a 4-kilowatt 120 volt direct-current generator, supplies power and light for stand-by service. The auxiliary generating set is also connected through a clutch to an Ingersoll-Rand type 15 4½-inch air compressor, which charges the air tank when no other power is available to start the main engines.

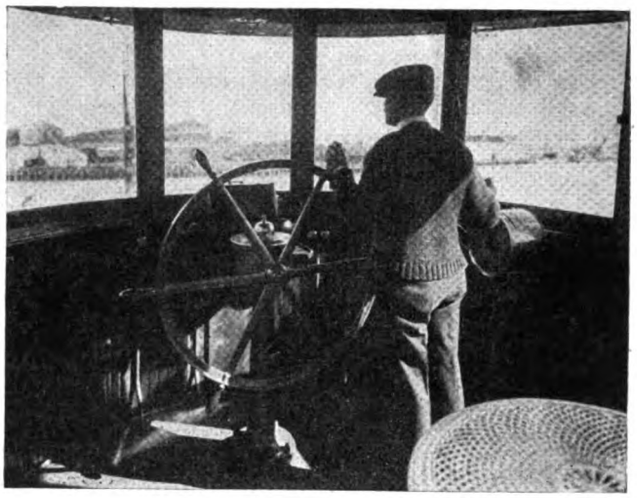
An Ingersoll-Rand type 15 compressor, driven by a 5-horsepower motor, charges the main air tanks from which the main engines are started.

Two Northern rotary circulating water and bilge pumps, are driven by 5 horsepower motors. These units have capacities of 175 gallons per minute against 30 pounds pressure. A Northern rotary fuel transfer pump is driven by a 2 horsepower motor. The steering motor (1½ horsepower 115-volt) operates at 550 revolutions per minute.

An American Radiator oil burning furnace is used for heating the pilot house, engine and crew quarters.

The power plant, propelling machinery and rudders are all controlled from the pilot house. When maneuvering, the captain keeps one hand on the steering wheel and the other on the control lever. With these, he can vary the speed of the propulsion motor from 0 to 130 revolutions per minute for ahead and stern movements. Due to the conservative rating of the power plant, reserve power is always available for emergency use.

The direction and speed of the double-armature pro-



Pilot house control of oil-electric tug

pulsion motor are controlled by the voltage of the generators. A single lever controls both the direction of rotation and the speed of the propelling motor. A control pedestal is located on either side of the pilot house, so that the captain may operate the tug from either side.

Eight outstanding advantages of this type of tugboat have been pointed out by Frederick W. O'Neil, chief engineer of the Ingersoll-Rand Company: Bridge control, constant full-load power, excellent torque performance, economical generation of power, decreased engine weight, power reserve, savings in service time, reduced operating costs.

Performance records of the oil-electric tug show that its average fuel cost per day, in 24-hour service, approximates $45, as against $156 for an equivalent steam tug, a difference in fuel cost of $110 a day in favor of the oil-electric.

The Rudolf Diesel Award

THE National Committee in charge of Oil Power Week, April 18-23, will award a cash prize of $100, accompanied by a suitable certificate, to be known as the *Rudolph Diesel award.*

The prize will be awarded for the best contribution towards the advancement of oil engines, either in the form of a paper presented at one of the meetings throughout the country under the auspices of the Oil Power National Conference, or a written discussion of a paper, by *anyone* attending any of the meetings.

Manuscripts should be in the hands of the National Committee, 29 West 39th street, New York, not later than June 1, 1927, and the award will be announced by August 1.

Oil Power Week will focus nation-wide attention on the production of cheap power by the use of oil in internal combustion engines.

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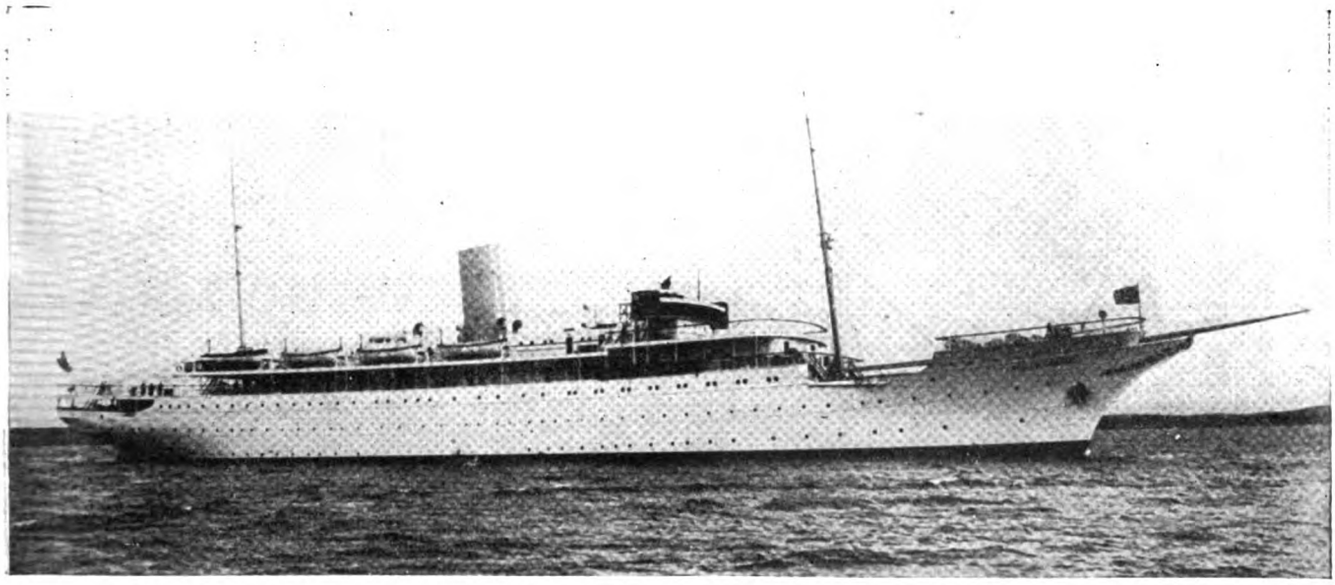

The 5,000-ton cruising yacht Stella Polaris

M. S. Stella Polaris—The Largest Cruising Yacht

First vessel of her type to be fitted with Diesel machinery— Everything except heating is electrically operated

By Our Special London Correspondent

VERY great interest has been evinced in Europe in the motor cruising yacht *Stella Polaris* which, at the end of February, started on her maiden cruise to the Mediterranean. She has the distinction of being the largest specially built cruising yacht and the first that has ever been constructed to be propelled by internal combustion machinery. Moreover, the owners, the Bergen Steamship Company, have a very wide experience of tourist traffic and have embodied the results of this experience in the new ship, so that she is considered to be the last word in the design of such a craft.

She has been built by the Gothenburg Shipbuilding Company, and is stated to have cost more than 4,000,000 Swedish kronor. She is designed in every way to give the appearance and impression, internally and externally, of an enormous yacht, and the illustrations show that this desire has been attained. She is 446 feet in length overall, 360 feet between perpendiculars with a molded beam of 50 feet 6 inches, and a draft of only 17 feet 6 inches, which, of course, renders her specially suitable for cruising in relatively shallow water such as some of the Norwegian fjords and the Mediterranean harbors. The gross tonnage is 5,020, the displacement somewhat over 6,000 tons and the cruising speed will be 15 knots.

A feature has been made of very large deck space for sight-seeing, and the boat deck is extended beyond the bridge, giving a very large promenade, nearly the whole width of the ship. Aft, for a distance of about 100 feet, there is, similarly, a promenade, extending the whole width of the ship.

The public rooms and cabins are of a scale that is unprecedented for vessels of this class. This may well be imagined in a ship 446 feet in length, which carries only 200 passengers, and, of course, no cargo.

Quite apart from the fact that the employment of internal combustion machinery in a tourist yacht is quite novel, the Diesel engines themselves are of special interest, since they represent another example of the tendency of numbers of Scandinavian shipowners to adopt the trunk piston, twin screw system. Moreover, the units fitted in the *Stella Polaris* are the highest powered of their type that have yet been constructed. They are eight cylinder engines with cylinders 550 millimeters bore and 1,000 millimeters stroke, the power developed being 2,600 indicated horsepower at about 170 to 175 revolutions per minute or a total of 5,200 indicated horsepower.

Hitherto, the largest motors of this design that have been installed in a ship are six cylinder engines of the same cylinder size, fitted in the cross-channel passenger and cargo vessel *Parkeston* placed in service about 18 months ago. Such a design is suitable for a passenger ship since the height is low and it may be noted that cabins are arranged all around the top of the engine room and noise and vibration do not trouble the passengers at all, indicating that Diesel engines are quite as suitable for passenger vessels as steam machinery.

Normally, the propelling machinery runs unsupercharged, but two electrically driven superchargers are installed, so that when it is desired to make up time, which may happen to a cruising vessel running to a close schedule and, for instance, encountering fog, the superchargers are brought into operation and 10 percent power is added to the shaft. This allows an additional speed of about half a knot, so that the maximum speed may be taken as something in the neighborhood of 15¾ to 16 knots.

Everything on the ship is electric apart from the heating, which is carried out on the thermotank system and involves the employment of steam supplied from two donkey boilers. The galley is, however, electric, the winches, boat hoists, anchor windlass, capstan, laundry and all the engine room auxiliaries are electrically operated. It will be gathered that the power needed is somewhat substantial and the electric

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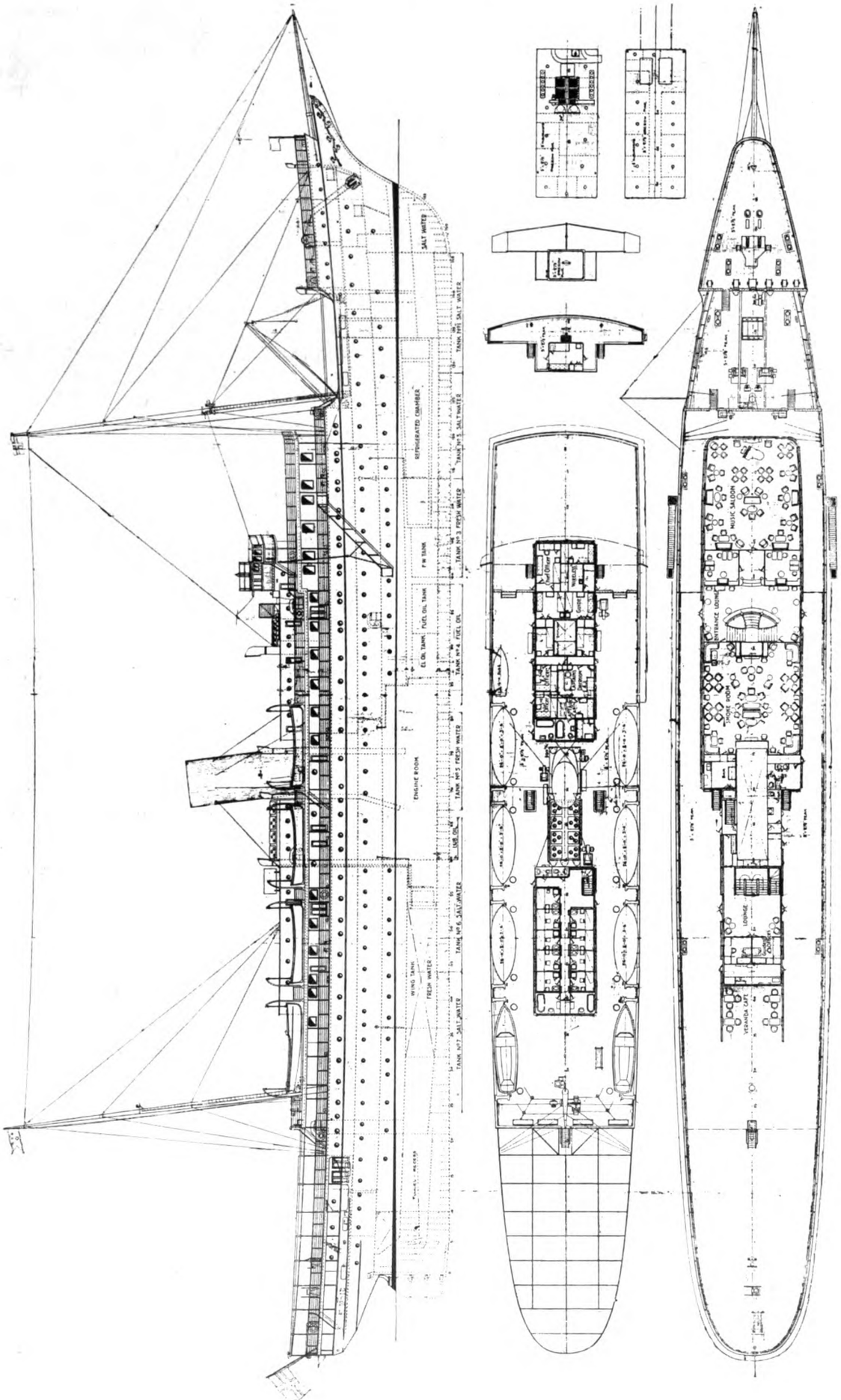

Profile and upper deck plans of the cruising motor yacht Stella Polaris

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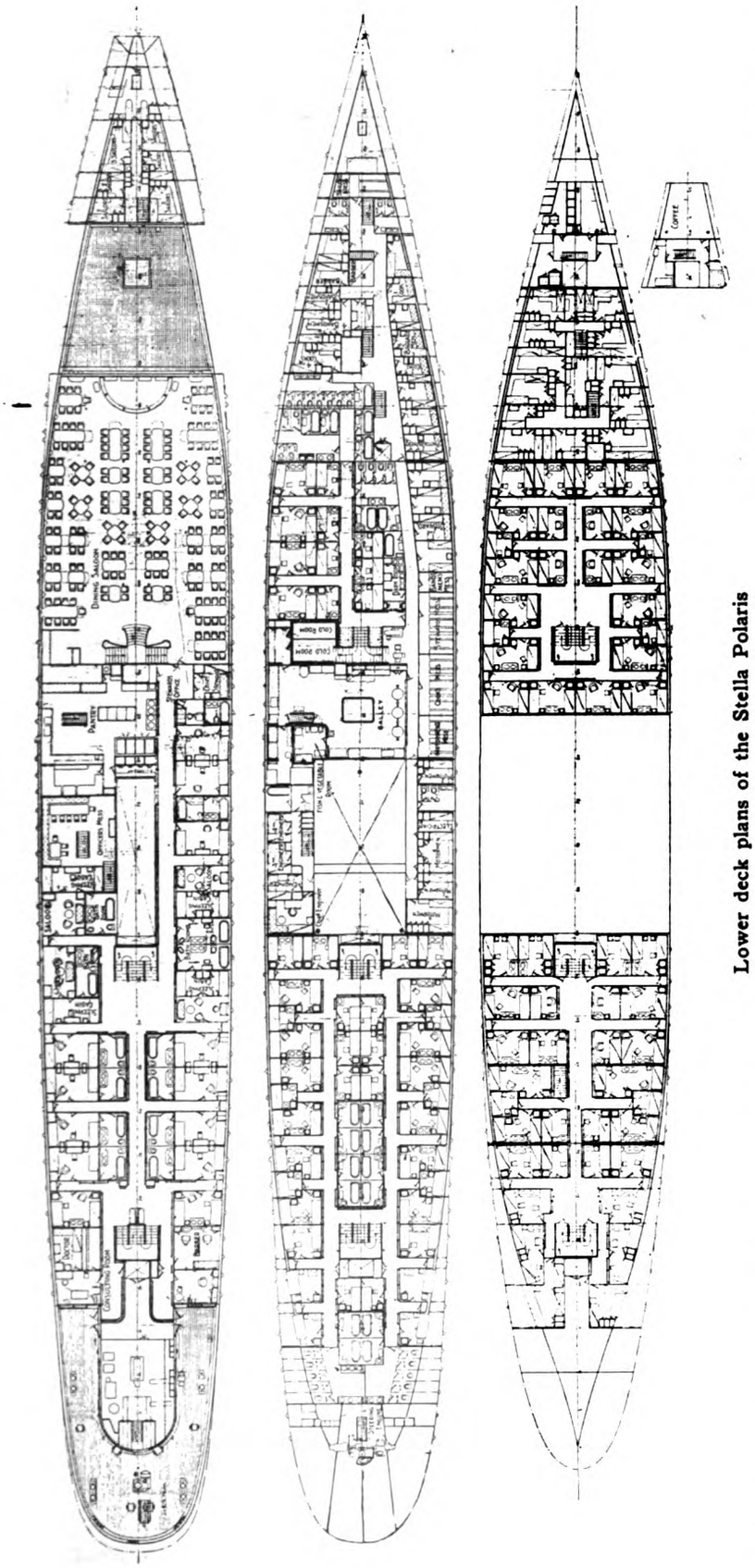
generating plant is somewhat curious. There are five units, four of about 100 kilowatts and the fifth of 66 kilowatts but this was installed solely for the purpose of supplying power to the superchargers when needed. The compressed air for starting the main engines is obtained from the compressors of the auxiliary Diesel engines, so that no special auxiliary compressors are needed.

After making several Mediterranean cruises, the *Stella Polaris* is to be engaged in the summer on cruises to the Norwegian fjords, the North Cape and Spitzbergen, and probably after that time will proceed on a tour around the whole world. It is the expectation of the owners that other shipowning companies which cater for such cruises will ultimately tend towards the construction of highly specialized relatively small craft of this type, rather than engage their big passenger liners on the service. At any rate, it represents something of a new development and is, therefore, of the utmost interest.



Lower deck plans of the Stella Polaris

Great Lakes Shipping Smashes Record in 1926

THE volume of bulk freight handled by vessels operated on the Great Lakes set a new record in 1926, according to an official report forwarded to Chairman T. V. O'Connor of the United States Shipping Board by the Lake Carriers' Association. The total movement during the year amounted to 121,289,502 net tons, a figure 8,000,000 tons greater than the movement in 1925, and 260,000 tons greater than in 1923, when the previous record was reached.

The report shows a total of 437 steel cargo ships and 32 steel passenger ships operating on the Lakes under the American flag, while 183 steel cargo vessels and 21 steel passenger vessels were listed as Canadian-flag ships. In addition, there are large numbers of tugs, wooden steamers, wooden barges and steel car ferries under each flag.

The total number of vessels operating as cargo carriers on the Lakes was increased from 752 to 755 during the year, and the capacity of the total climbed from 4,322,317 gross tons on January 1, 1926, to 4,372,767 gross tons on January 1, 1927. The change in this total resulted from a loss of 36,800 gross tons and the addition of 87,250 gross tons in new ships.

The movement of bulk freight, which is by far the most important traffic on the Lakes, shows substantial advances in all departments excepting grain. The movement of iron ore amounted to 58,538,000 tons, a gain of about four and one-half million gross tons over 1925; coal shipments totaled 31,011,000 gross tons, a gain of 3,000,000 gross tons over 1925, stone shipments advanced 1,300,000 tons to a total of 12,628,000, while shipments of the various kinds of grain fell off about 1,300,000 gross tons to 12,087,000 for last year.

FERRY BOAT LAUNCHED.—The Northwestern Pacific ferry boat *Santa Rosa* was launched at the yards of the General Engineering and Dry Dock Company, Alameda, Calif., on March 17. The new boat, which is 256 feet long and equipped with Diesel electric drive, will accommodate 500 passengers and 50 automobiles. She will go into service May 10.

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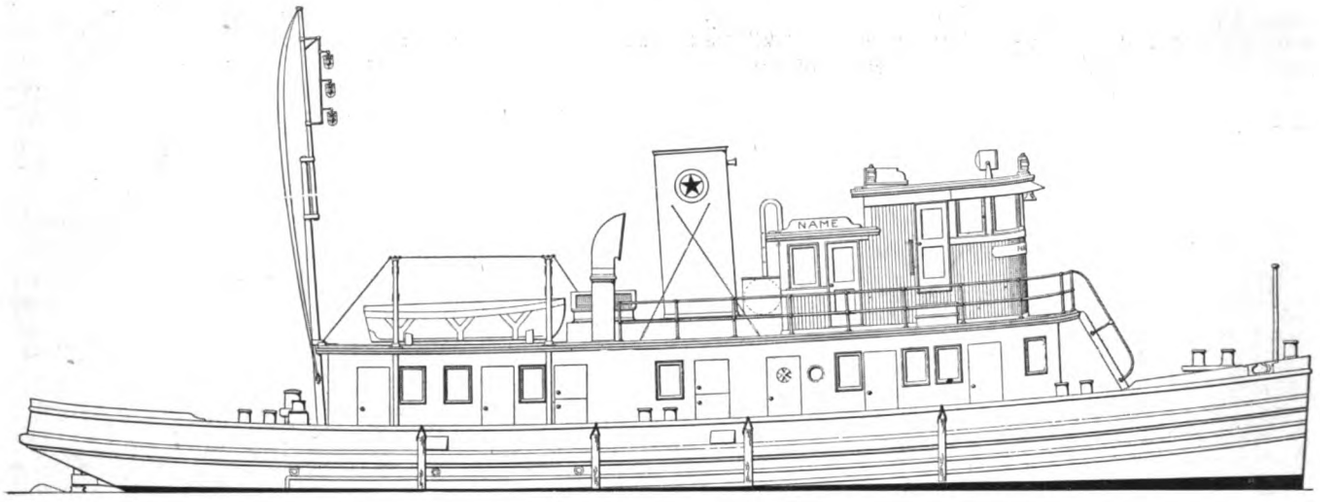
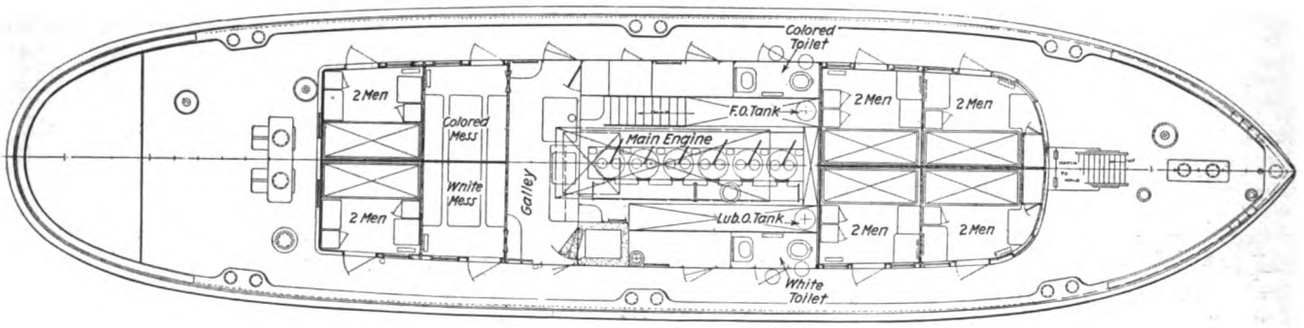
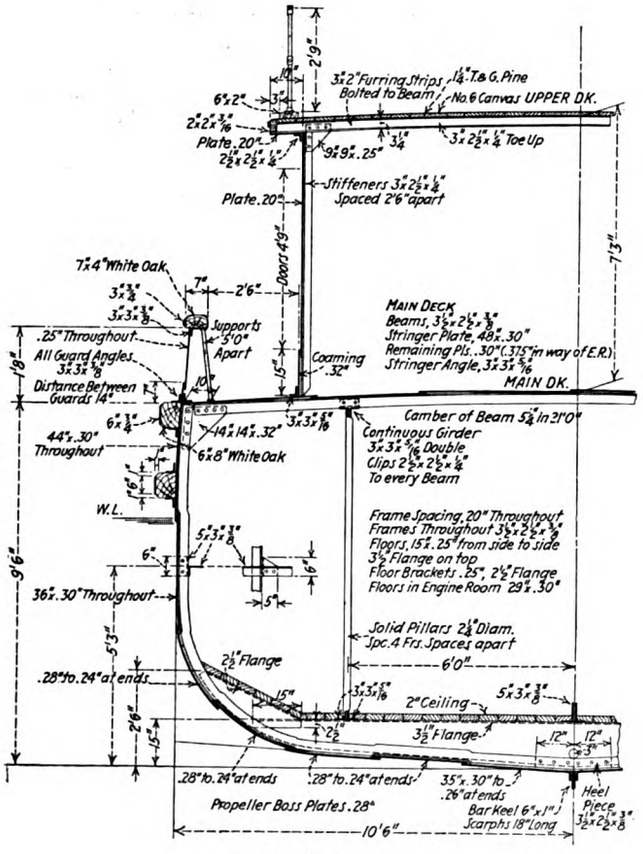
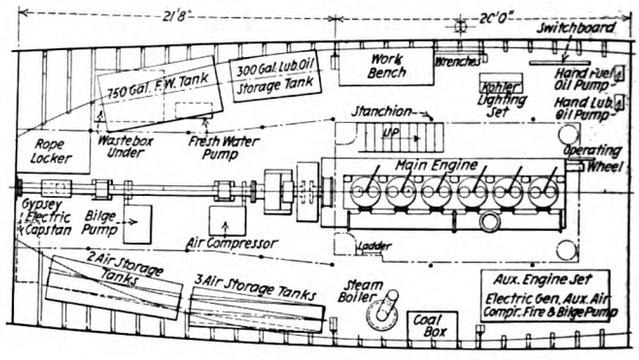




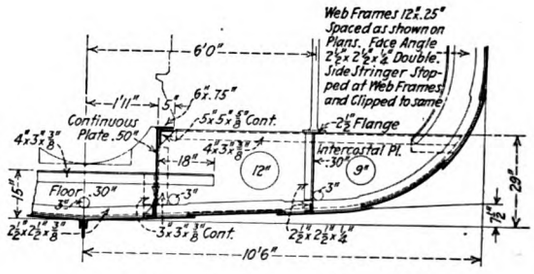
Profile and deck plan of Diesel tug for Gulf service



Midship section



Plan of engine room



Section through engine room

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Powerful Diesel Tugboat for Gulf Ports Service

Ninety-foot steel tug, designed by Cox & Stevens, under construction at Marvel yard—Equipped with 500 horsepower Nelseco Diesel engine

A CONTRACT for a single screw steel Diesel tugboat for the International Cement Corporation has been awarded to Harry A. Marvel of Newburgh, N. Y., and is now under construction at the Marvel yard. The vessel was designed by Cox & Stevens, consulting naval architects and marine engineers, 341 Madison avenue, New York, and is to be used for towing barges between ports on the Gulf of Mexico and adjacent rivers.

The principal dimensions of the vessel are as follows:

Length overall	90 feet
Length on waterline	82 feet
Beam molded	21 feet
Depth molded	9 feet 6 inches
Mean draft	7 feet

The vessel is of steel construction throughout, with the exception of the fenders, the joiner work in main deckhouse, the upper deck and the upper deck house, which are of wood. The upper deck beams and the fidley are of steel construction. In way of the engine casing light steel plating is provided under the wooden decking abreast the fidley for fire protection. The hull below the main deck is divided into 5 compartments by transverse watertight bulkheads forming the fore peak tank, forward hold space, machinery space, aft peak tank and lazarette.

The peak tanks are arranged to carry water ballast and will effectively alter the trim of vessel to meet the various existing draft conditions encountered in service. Fuel oil is carried in independent tanks located in the forward hold.

The main deckhouse contains 6 staterooms, accommodating 12 men, a galley, two mess rooms, engine casing, two toilets, ice box, lamp locker and store room. The arrangement provides separate accommodations for white and colored crew. The upper deck house contains a raised pilot house and the captain's room accommodating 2 men. All deckhouse windows are of the vertical sliding type of large size to provide ample ventilation and all doors and windows are screened. A small steam heating plant is provided for heating the living quarters.

A hand steering gear of the usual tugboat type with rod and cable transmission between the pilot house and quadrant is provided. An American Engineering type 3-A gypsy driven by a 5 horsepower Electro Dynamic motor is located on the main deck with the motor under the deck.

Propelling Machinery and Auxiliaries

The main engine is a Type 6 MIR-22, 6 cylinder, 4 cycle, mechanical injection, direct reversible, Nelseco marine Diesel engine, direct connected to the propeller shafting. It is designed to develop 500 brake horsepower at 235 revolutions per minute.

A Worthington 2 stage, 50 cubic foot displacement air compressor and a Gould 1½-inch suction reciprocating bilge pump are driven off the intermediate line shaft.

The auxiliary engine set consists of a 10-12 horsepower, 2 cylinder, Palmer gasoline engine, driving through a chain a 5-kilowatt Electro Dynamic 110 volt direct current generator and direct connected at one end to a Nelseco 5-cubic foot capacity air compressor and at the other end to a Gould rotary fire and bilge pump having a capacity of 100 gallons per minute at 70 pounds pressure.

The emergency electric plant is a Kohler 1,500-watt, model DP, gasoline engine driven, 110-volt, direct current generator set with a starting battery.

Hand operated emergency lubricating oil and fuel oil transfer pumps of Gould make are provided. The fresh water transfer pump is a motor driven Gould centrifugal of 20 gallons per minute capacity.

Motorship Sawokla Placed in Commission

Busch-Sulzer two cycle engine performs well on sea trials of converted Shipping Board vessel

THE motorship *Sawokla,* which is the latest Shipping Board vessel to be converted from steam to Diesel engine drive, held her sea trials on Saturday, March 12, off the Virginia Capes. The tests, which were witnessed by a number of guests and Shipping Board officials, included a 6-hour run at full power. This run was carried out at an approximate speed of 12.3 knots, which exceeded the requirements. Further tests were made to determine the maneuvering ability of the vessel and of the new engines. The results were entirely satisfactory and the motorship *Sawokla* was officially accepted by the Shipping Board and allocated to the American-Republics Line for a voyage to the east coast of South America. On her return the vessel will be permanently allocated to the Roosevelt Steamship Company of New York for service between North Atlantic ports and Australia in which trade 5 converted Shipping Board vessels are now engaged.

The general hull details of the *Sawokla,* as well as the propelling machinery, auxiliaries and the like follow:

Length overall	416 feet 0 inches
Length between perpendiculars	402 feet 0 inches
Beam, molded	54 feet 0 inches
Depth, molded at side to shelter deck	33 feet 9 inches
Displacement at normal mean loaded draft	13,010 tons
Gross tonnage	5,878 tons
Net tonnage	3,689 tons
Normal mean load draft	26 feet 10¾ inches
Deadweight capacity on above draft	9,125 tons
Bale capacity, not including deep tanks	455,660 cubic feet
Capacity of deep tanks, salt water	1,053 tons
Capacity of inner bottom fuel oil tanks	760 tons
Normal speed, service conditions	11.6 knots

The main engine, which was built by the Busch-Sulzer Bros.-Diesel Engine Company of St. Louis, Mo., is of the 6 cylinder, single acting, two cycle, air injection type developing 3,000 brake horsepower at 90 revolutions per minute. The working cylinders have a diameter of 30 inches and a stroke of 52 inches. The piston speed at 90 revolutions per minute when the engine is developing the rated horsepower is 780 feet per minute. The installation

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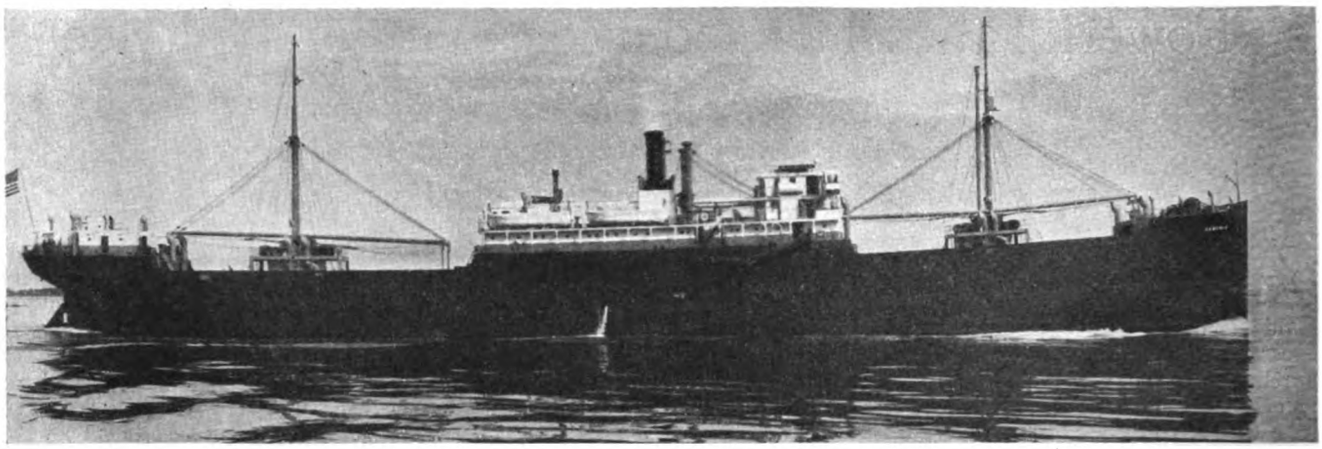
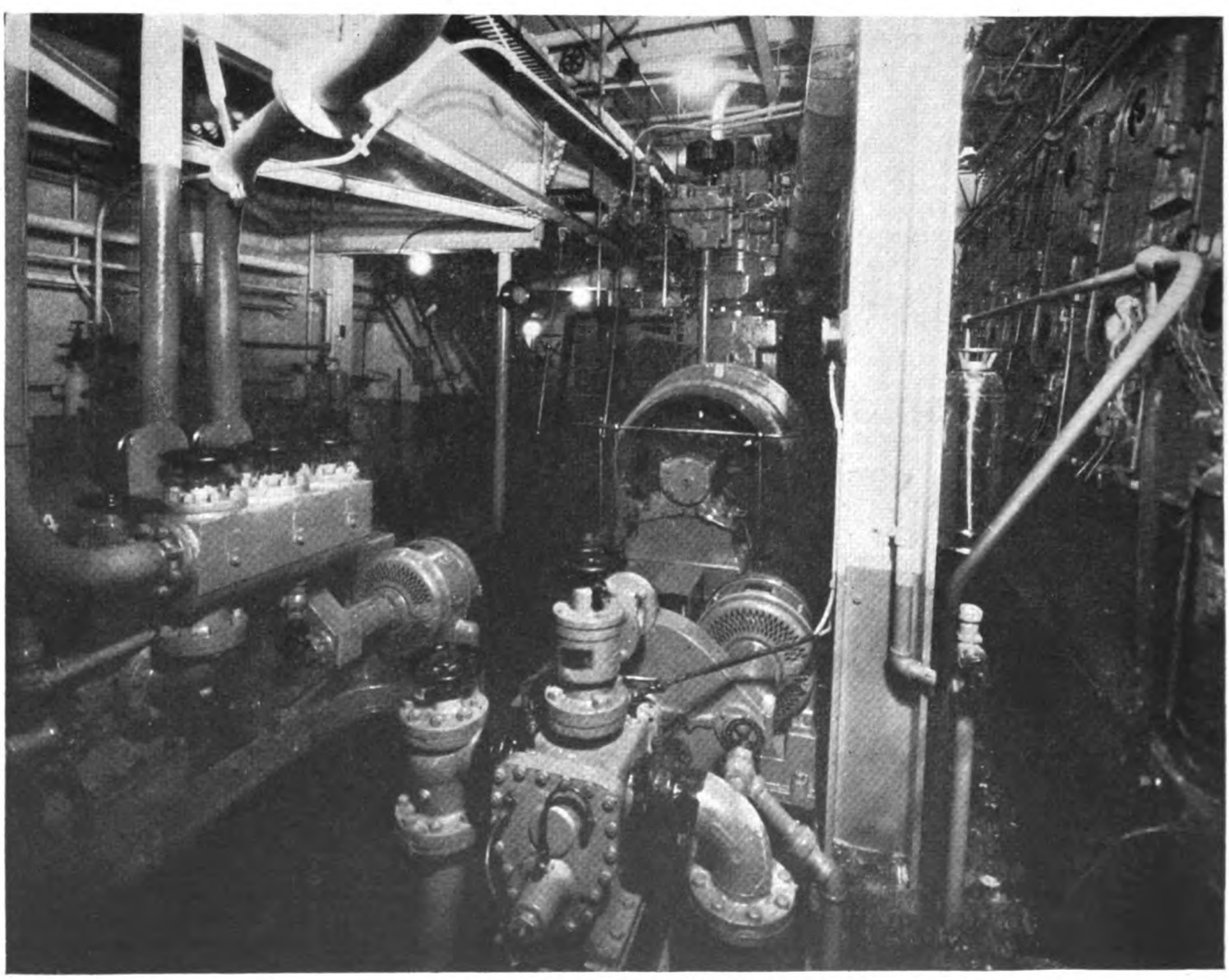


The Shipping Board motorship Sawokla

includes two air starting tanks each having 635 cubic feet and two air starting tanks rated at a working pressure of 400 pounds per square inch maximum. Complete details of this engine were given in the October, 1926, issue of Marine Engineering and Shipping Age, page 579.

The *Sawokla* is equipped with 3 auxiliary Diesel engines built by the Worthington Pump & Machinery Corporation, New York. These engines are of the 3 cylinder, single acting, two cycle, air injection type developing 115 brake horsepower each at 265 revolutions per minute. The working cylinders have a diameter of 12½ inches and a stroke of 13¼ inches. At the rated horsepower these engines have a piston speed of 585 feet per minute. The auxiliary engines are each directly connected to a 75-kilowatt, 240-volt Ridgway generator.

The emergency lighting and compressor set consists of a Mianus Diesel Engine Company 3 cylinder, single acting, two cycle, solid injection Diesel engine developing 22 brake



Starboard side of the engine room, looking aft

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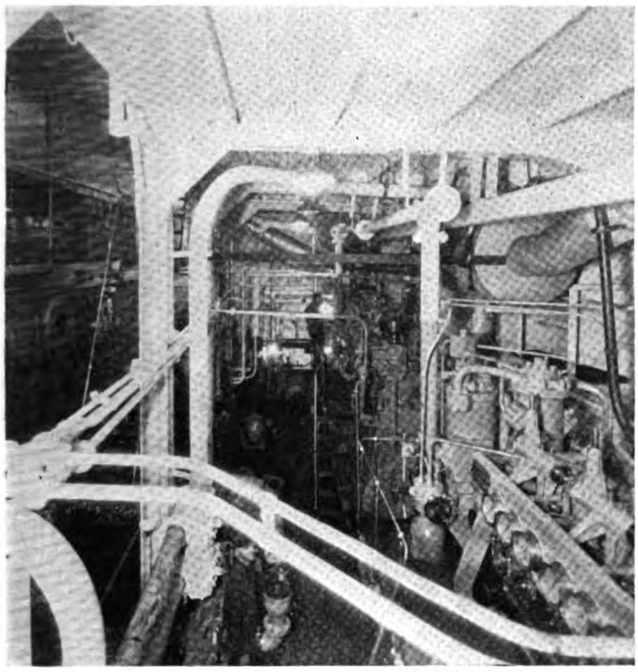
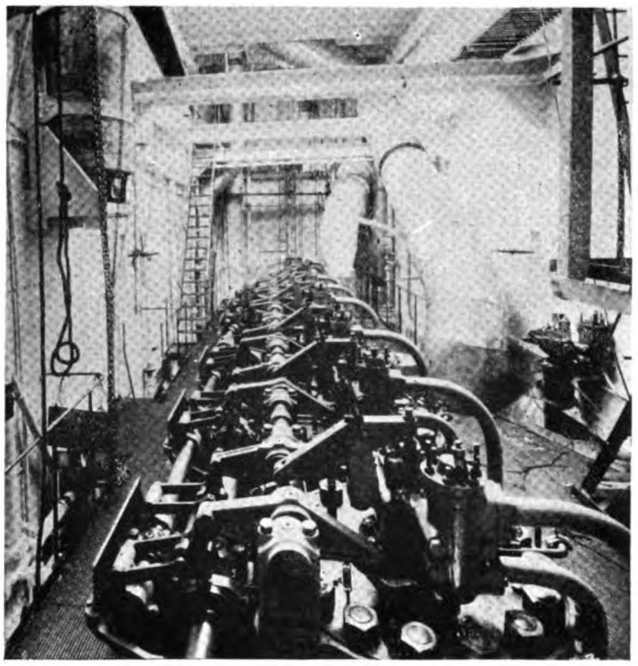


Port side of engine room, looking aft

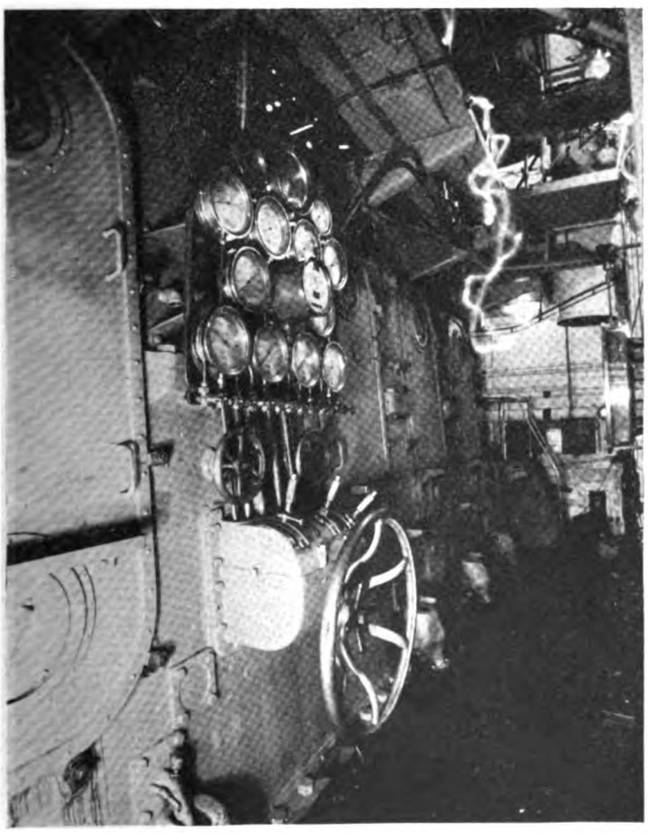


Top of main engine

horsepower at 550 revolutions per minute. This engine is direct connected to a 14-kilowatt Diehl generator and a Rix compressor.

The water pumps installed on the *Sawokla* were manufactured by the Nash Engineering Company of New York. This equipment includes:

1 salt water, self-priming, centrifugal cooling pump with a capacity of 750 gallons per minute driven by a General Electric 30-horsepower motor.
1 general service, self-priming, centrifugal pump with a capacity of 750 gallons per minute driven by a General Electric 30-horsepower motor.
5 centrifugal pumps with a capacity of 200 gallons per minute each driven by a General Electric 20-horsepower motor.
1 engine room bilge, self-priming, centrifugal pump with a capacity of 300 gallons per minute driven by a General Electric 7½-horsepower motor.
1 fresh water (washing), self-priming, centrifugal pump with a capacity of 70 gallons per minute driven by a General Electric 7½-horsepower motor.
1 sanitary centrifugal pump with a capacity of 70 gallons per minute driven by a General Electric 7½-horsepower motor.



Operating station in engine room

Looking forward on main deck

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1 fresh water (potable), centrifugal pump with a capacity of 35 gallons per minute driven by a General Electric 1½-horsepower motor.

The lubricating oil pump, built by the Kinney Manufacturing Company of Boston, Mass., is of the rotary plunger type driven by a 7½-horsepower General Electric motor. The capacity of this pump is 150 gallons per minute. The fuel oil transfer pump made by the same company is a duplicate of the first. The heating boiler installed is of the vertical type equipped with a Sunbeam centrifugal atomizing oil burner. The heating surface of this boiler is 173 square feet, while the working pressure is 110 pounds per square inch.

The ice machine is a York 2-ton ammonia direct expansion type driven by a Diehl motor at 235 revolutions per minute. Steering control is by means of a Sperry telemotor with a Westinghouse control panel. The Sperry equipment is of the automatic hand type with an automatic follow-up and includes hand control with non-follow-up.

The winch equipment includes 10 cargo and one warping winch made by the Lidgerwood Manufacturing Company. These are of the self-oiling type driven by Westinghouse motors and are equipped with Cutler-Hammer shoe brakes. The old windlass on the vessel was rebuilt for motor drive, which consists of a 45-horsepower Westinghouse motor and control panel and a Cutler-Hammer shoe brake. The Rich system of fire protection is installed on the *Sawokla* together with the Walter Kidde & Company, Inc., Lux carbon dioxide system for extinguishing fires. Three oil separators are installed which were made by the De Laval Separator Company. These include two fuel oil separators having a capacity of 300 gallons per hour which are of the pressure type and one lubricating oil separator of the open type having a capacity of 150 gallons per hour.

Among the apparatus fitted aboard this vessel, the Nash pumps, the Kinney pumps, the steering gear control, the winches, the winch control circuits, the winch control equipment mounting, electric heaters and Sperry visible whistle were all especially redesigned for the Shipping Board Diesel conversion program to meet special requirements and have never been used before except in connection with this program.

The entire work of converting the *Sawokla* to a Diesel ship was made at a cost of $819,600 at the Newport News Shipbuilding & Dry Dock Company yards, Newport News, Va.

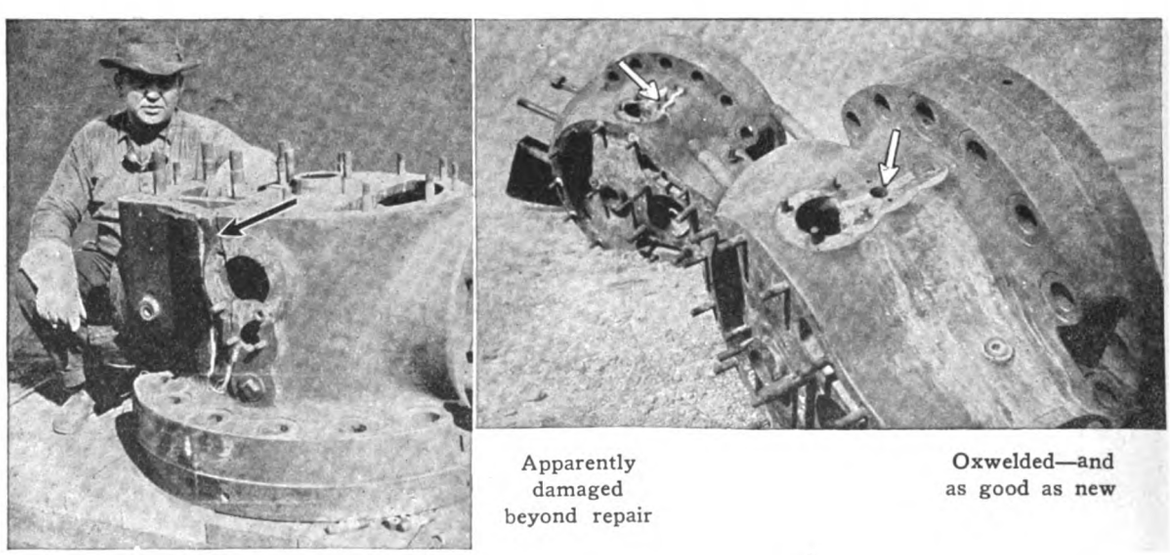
Service Overcame Skepticism*

Welding cracked cylinder head nets big saving and proves to superintendent that it can be done

SERVICE operators busy themselves these days destroying that pernicious bug called skepticism. Incidentally they usually point the way to money savings for those manufacturers who have repair work on their hands and who solicit their help.

Not long ago, when visiting a western plant, an operator was shown several cracked cylinder heads such as illustrated. He suggested welding them, but the superintendent was extremely skeptical. He doubted that cast iron could be welded. However, he gave permission to weld one of the castings, saying that the heads were no good anyway, so there wasn't much to lose. If it proved that the job could be successfully done, he would have the others repaired in the same way.

Working with and instructing the two company welders, the operator superintended the repair of four cylinder heads. It is almost needless to say that the welding was eminently successful and the superintendent was entirely satisfied that his doubts were unfounded.



Apparently damaged beyond repair

Oxwelded—and as good as new

The superintendent's skepticism was thoroughly overcome by this work. Furthermore, since replacement of the four cylinder heads would have cost $3,200, as compared with the fact that repairs amounted to only $463, service saved the company $2,737. Oxwelding cast iron is, of course, now a routine operation at this plant.

* From *Oxy-Acetylene Tips.*

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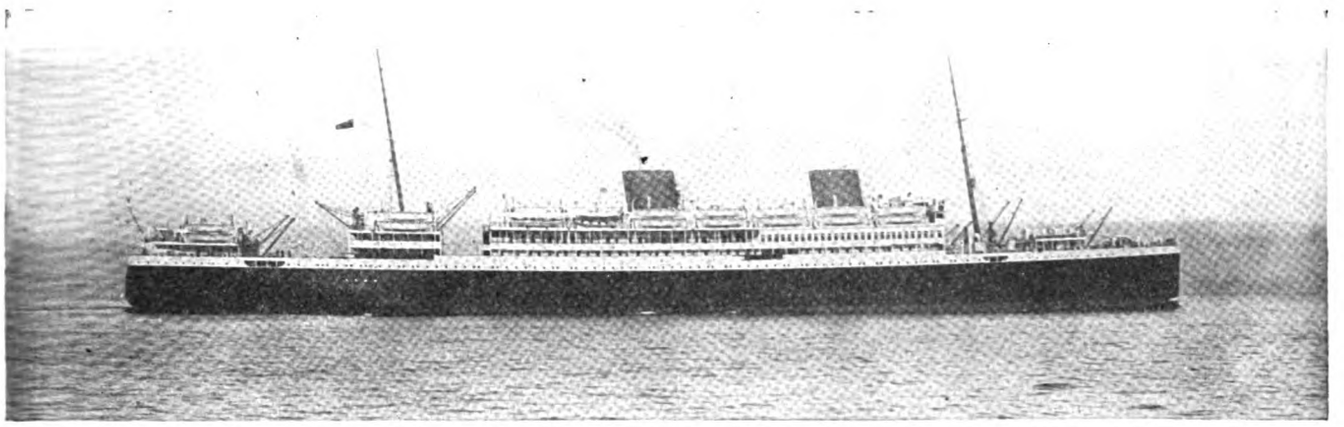


The Royal Mail Steam Packet motor liner Alcantara

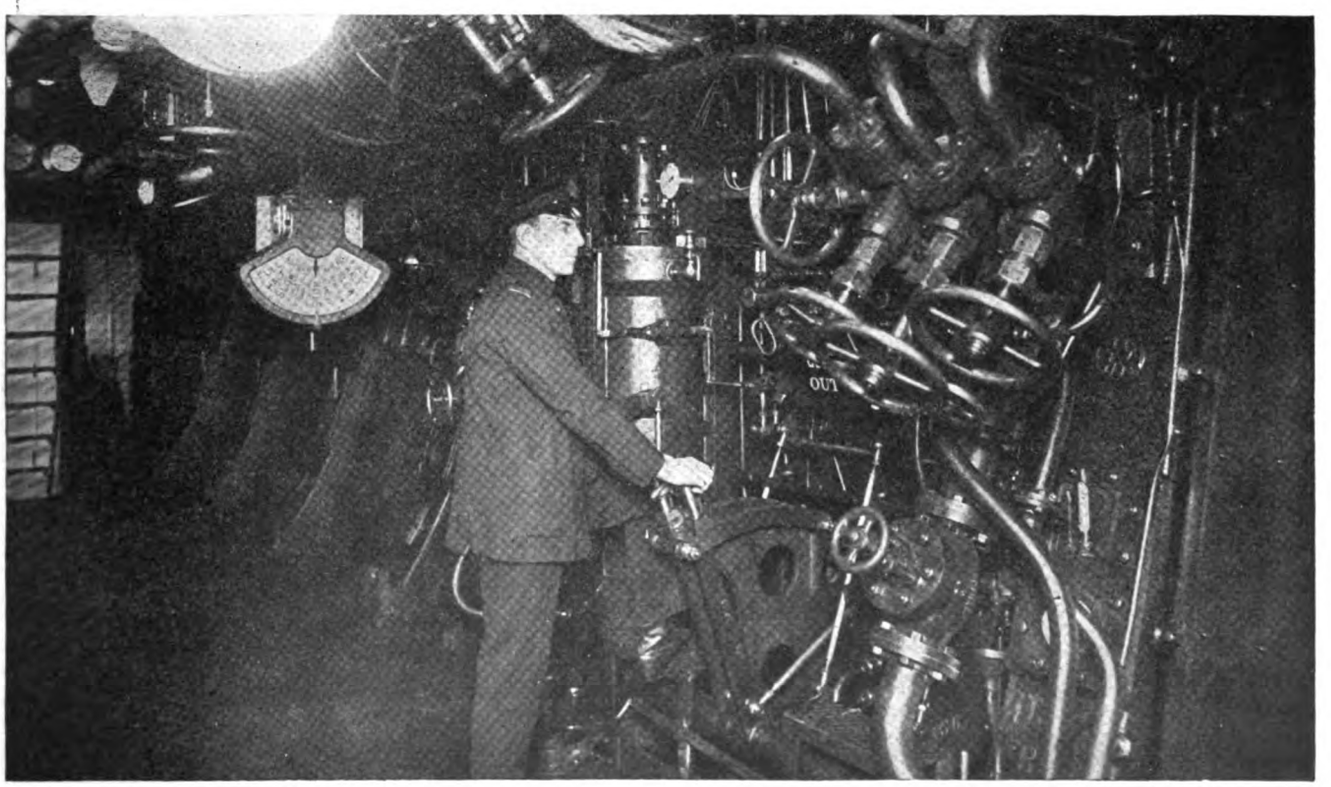
The Royal Mail Motor Liner Alcantara

Twin screw vessel fitted with four cycle, double-acting machinery of 20,000 indicated horsepower

By Our Special London Correspondent

IT is natural that the new motor liner *Alcantara* built for the Royal Mail Steam Packet Company's mail service between Southampton and Buenos Aires should not attract quite the same interest in shipping, shipbuilding and engineering circles as did the sister ship, the *Asturias,* which has now been in operation more than a year and, at the moment, is engaged upon a long pleasure cruise. For there are few points of dissimilarity between the two vessels, although, naturally, certain improvements have been embodied in the machinery as a result of the experience gained, while in the decoration of the main public rooms an entirely different scheme has been adopted.

It is unnecessary to describe the ship in considerable detail, but some particulars will be of interest. She has an overall length of 655 feet 8 inches, a molded beam of 78 feet and a depth of 45 feet, while the gross tonnage is 22,181. She has accommodation for nearly 500 passengers in the first class cabin, about 200 in the second class, while there are nearly 700 berths for third class passengers, about half of these being in cabins.



Starting platform

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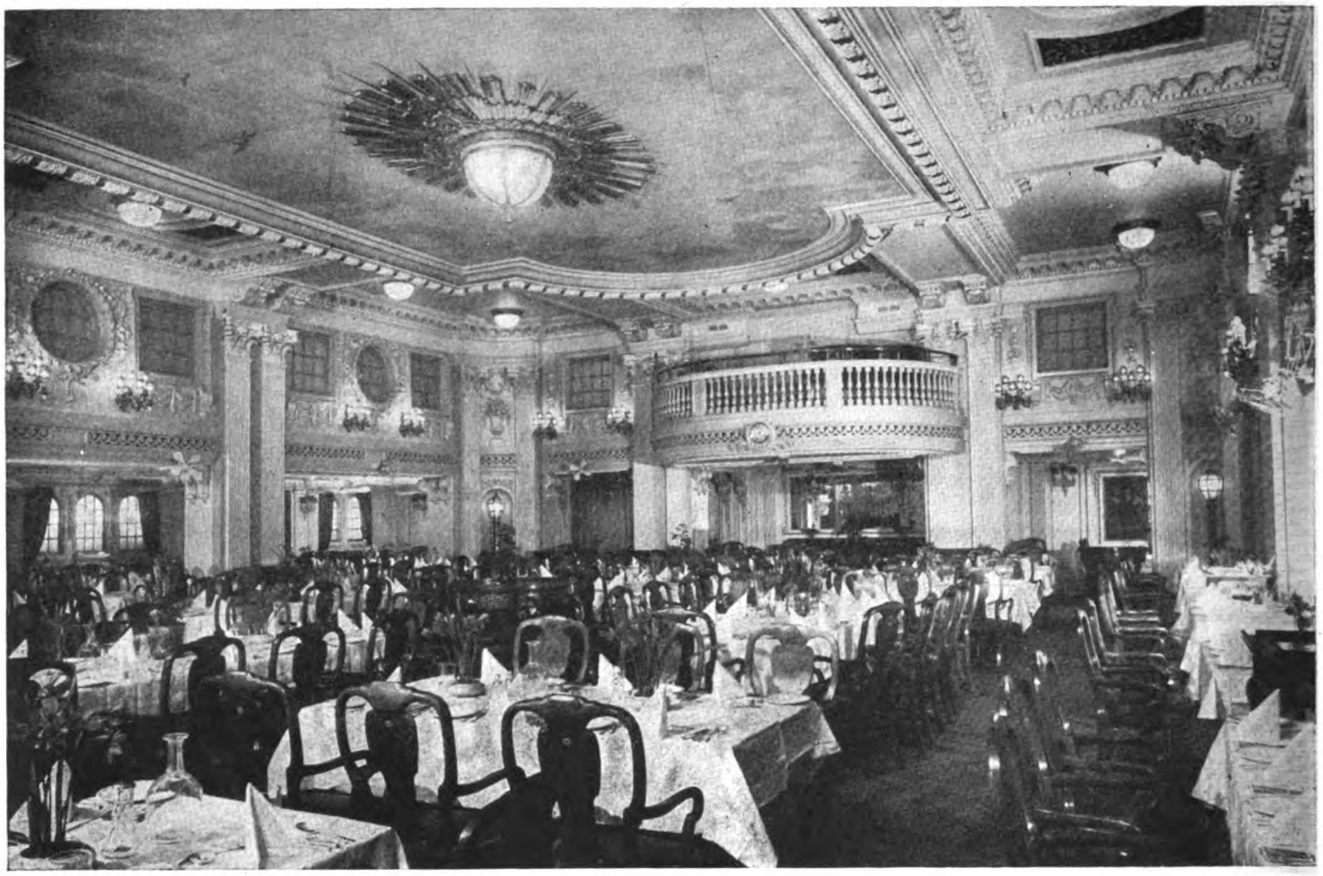
The *Alcantara* is a distinctive ship, for instead of having the usual high steamer funnel there are two, both of which are low and rather squat. She has a cruiser stern and the resultant profile is certainly impressive, although some consider that the height of the funnels might have been increased to a certain extent.

There are some very attractive public rooms. The winter garden on the boat deck is eminently suitable for a vessel which, for the greater part of its voyages, encounters hot weather. It is fitted out in Spanish style, and all the furniture is in cane, although the upholstery is of Oriental design. The social hall takes the height of two decks and thus affords an impression of spaciousness. In this room,



Dining saloon

as, indeed, in most of the others, characteristic Spanish decoration is provided, the reason, of course, being that the vessel is so largely used by passengers from the Argentine.

The other public rooms include a reading and writing room, lounge and the usual oak panelled smoking room, besides which there is a fine gymnasium, a swimming bath and children's playroom. In the first class dining saloon, there is seating accommodation for 412 passengers and this apartment is 94 feet long and 74 feet broad, the central hall being 17 feet high. There are several suites, comprising a bedroom, sitting room and bath, decorated in various styles, and, in addition to the single and two berth cabins, a certain number are arranged to carry three passengers if necessary.

The Double Acting Machinery

The *Alcantara* was built by Harland and Wolff who also manufactured the machinery. It is of the Burmeister & Wain double acting, four cycle type and the two engines are each designed to develop 7,500 brake horsepower or 10,000 indicated horsepower at 115 revolutions per minute but, in service, the normal speed of 16 knots is attained with a somewhat lower power, the engines turning at from 105 to 110 revolutions per minute.

They each have eight cylinders 33 inches in diameter with a piston stroke of 59 inches and drive tandem three-stage compressors. The arrangement of the structure of the engine is the same as the motors of the *Asturias*, the upper cylinder covers being bolted together and the two engines braced together at the top by horizontal tie rods. It has, however, now been decided to make an alteration to this double acting design and to give the cylinders freedom of movement at the top. Actually, such an arrangement was fitted in the motor liner *Accra* where the engines were of the same design but of lower power. It is understood that in all future Burmeister & Wain double acting, four stroke motors the new system will be employed, and it is, for instance, to be adopted in the *Kungsholm*, the new 18,000-ton liner which is being constructed for the Swedish American Line.

Auxiliary Machinery

In order that the oily vapor, which may escape from the crank case, should not contaminate the engine room, it is extracted by means of two fans and delivered to a condenser, where any oil in the vapor is condensed so that the engine room is kept free from pollution. In the *Asturias*, it was at first found that the ventilation of the engine room was not quite as satisfactory as might be desirable and this was improved. In the *Alcantara* the necessary additional ventilation has been provided and no complaint can be made on this score.

The auxiliary machinery is, for the most part, located in

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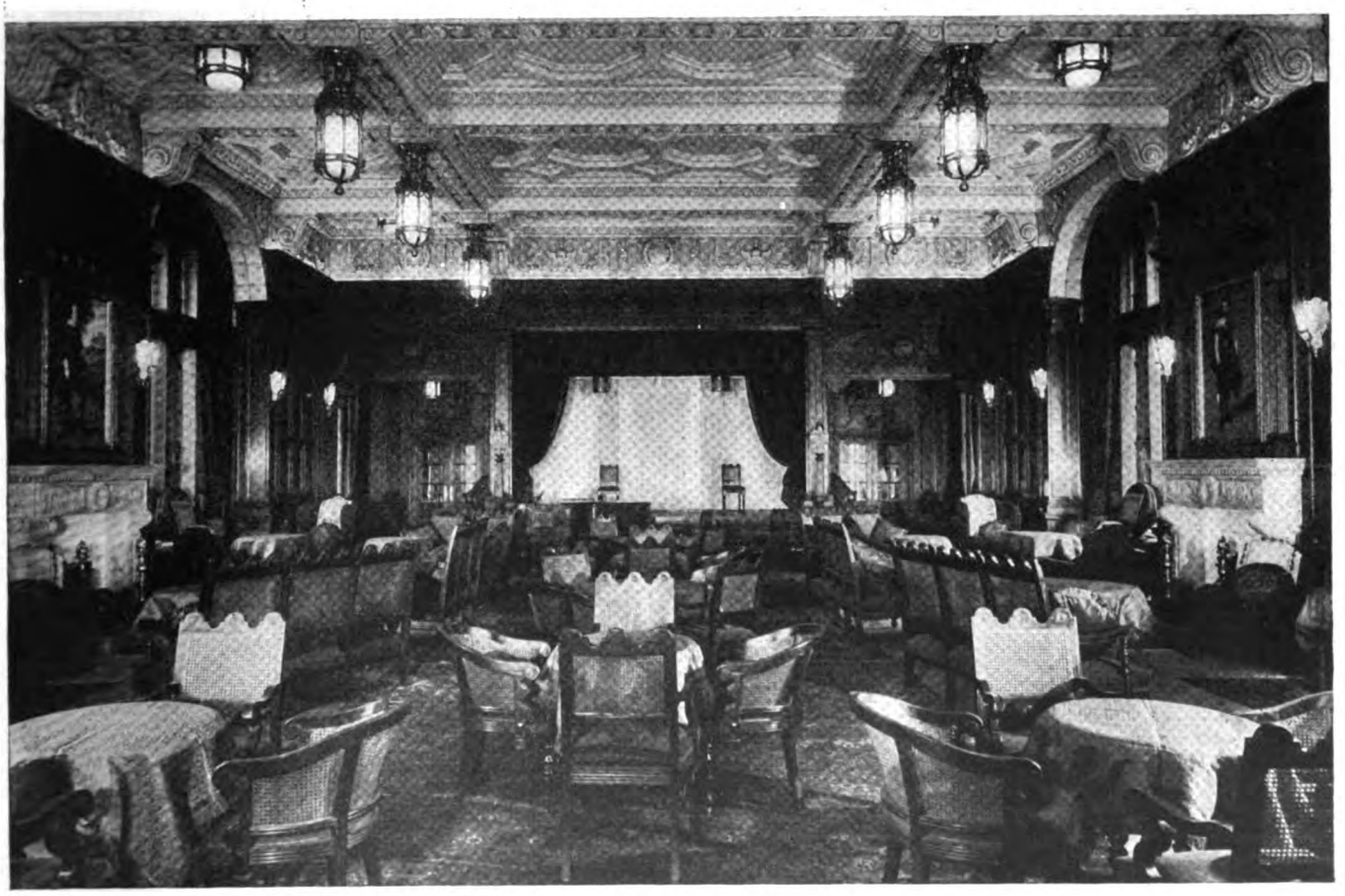
Winter garden



Social hall

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a special compartment separated from the main engine room by a bulkhead. In general, it may be taken that the auxiliaries in the main engine room are only those required for operating the propelling engines. In the auxiliary machinery space are four 600 brake horsepower Diesel engines each driving a 400-kilowatt dynamo, running at the very moderate speed of 180 revolutions per minute. Incidentally, it may be remarked that several manufacturers are tending to adopt higher speed auxiliary generators for the purpose of reducing cost and size, and 300 to 400 revolutions per minute is quite a common speed. But this is, naturally, for smaller units than those fitted in the *Alcantara.*

In addition to the generating plant, the ship's main pumps and certain other auxiliaries are installed in the auxiliary engine room. There are three electrically driven maneuvering compressors, each of 180 brake horsepower, but these are fitted in the main engine room, being considered as accessories of the propelling engines.

Although no official results have ever been published regarding the fuel consumption of these engines, it is understood that it works out at rather under 0.4 pound per brake horsepower hour, including the air compressor. The builders claim, however, that with the *Gripsholm* type, having the air compressor separately driven and with the new design of fuel valve for the bottom of the cylinders, a consumption of well under 0.35 pound per brake horsepower hour is reached. The total daily fuel consumption on the *Alcantara* is in the neighborhood of 55 to 60 tons for the propelling engines and about another 9 tons for the auxiliary generating plant. A certain amount, probably not exceeding about 2 or 3 tons, is also needed for the boiler, but the total is probably not over 70 tons daily throughout a long voyage.

Bromfield Diesel-Diehl Auxiliary Power Plant

THERE has just been placed on the market the latest model of the Bromfield Twentieth Century Diesel-Diehl auxiliary power plant (patents pending) supplying air, water, electric light and electric power for marine service by the Bromfield Twentieth Century Manufacturing Company, 88 Broad street, Boston, Mass. This power plant is the result of a number of years of experimenting and testing both at the factory of the company, 15 B Street, South Boston, Mass., and in actual sea service. The problem of consolidating in one complete set a number of separate power units has been successfully accomplished. The plant is not only compact (the steel base occupies a space 71 inches by 32 inches) but the units are accessible and easy to operate with many unnecessary parts eliminated. The entire outfit is exceptionally strong, rigid and is proof against disorders caused by vibrations.

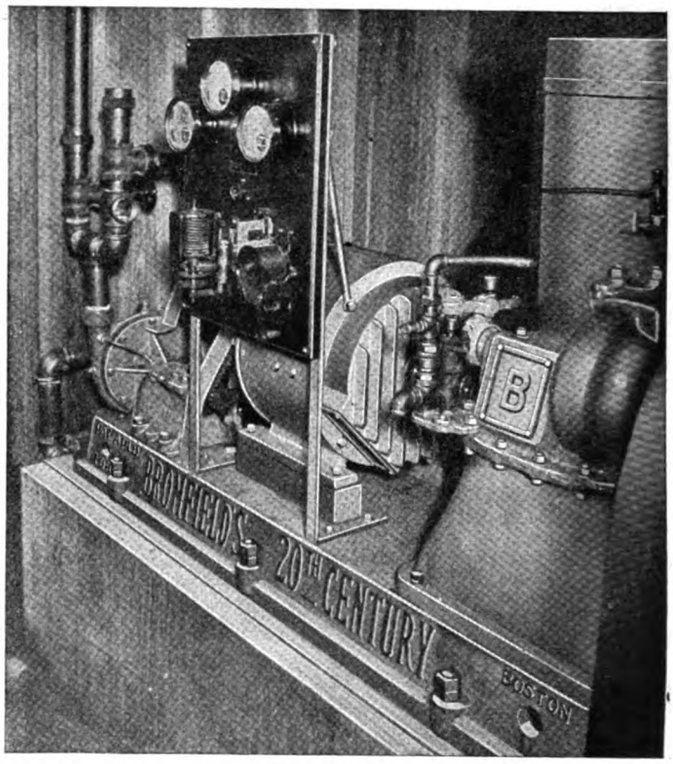
Not the least important feature of the Bromfield plant is the simplicity of operation of these three essential units. The Diesel engine, cold starting 4 cycle type, supplies power to the Diehl generator which in turn supplies light and power current; the air compressor supplies air for the main engine. Since most Diesel engines are of the direct connected reversible type, a supply of air is needed that far exceeds the actual amount available from the main pump. A large auxiliary air compressor is incorporated in the Bromfield plant, providing the means of overcoming this condition and producing a reserve supply of air sufficient to meet all requirements. Air is obtained, immediately, in the Bromfield Diesel-Diehl set by throwing the lever. Heretofore the engineer had to prime and crank the gasolene engine several times before it would start.

The third unit of the Bromfield Diesel-Diehl plant is a large centrifugal pump with an 83 gallon per minute capacity which is connected to the bilge and sea cock. This is also controlled by the lever.

The air compressor and water pump are operated by a two-way easily operated clutch held on a ball bearing shaft which extends through the generator. Throwing the clutch forward engages the air compressor and pulling it back engages the water pump. The clutch when in the center position is neutral.

The severe strain on the clutch, when the air compressor pumps at a high pressure, has been eliminated as the clutch has been designed so that there is a friction contact when it is engaged part way and, when the lever is forced a little more, dogs are engaged making a solid connection, thereby eliminating any possible slipping.

The Bromfield's Twentieth Century Diesel-Diehl power



Auxiliary power plant that combines generator, compressor and pump

plants have been used successfully for a number of years on board large fishing schooners, tug boats and private yachts. Among the more prominent installations are: Fishing schooners, *Gosson, Dawn, Shamrock* (American entry in International Fishing Schooner race), *Adventure;* private schooner, *Roseway;* beam trawler, *Mariner.*

Marine Library Association Starts Book Drive.—A book collection drive for the benefit of the men of the American merchant marine has been started by the American Merchant Marine Library Association, 82 Beaver street, New York, with the co-operation of several organizations in New York city and its environs. The books sought for this purpose include biography, history, the classics, college entrance text books, works on navigation, fiction dealing with the sea, as well as English primers for the use of the foreign born seamen. The men in the Coast Guard service, the lighthouse service and in the life saving stations participate in the use of the quarter of a million books circulated by the Library Association.

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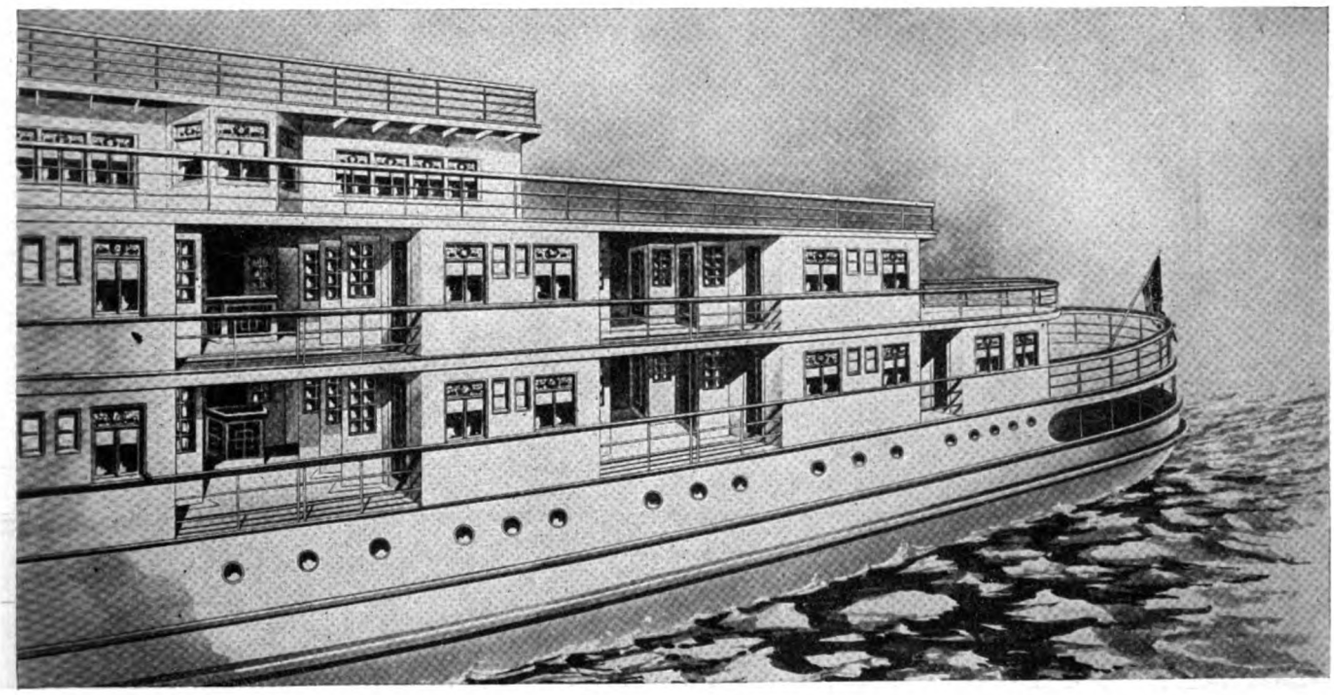


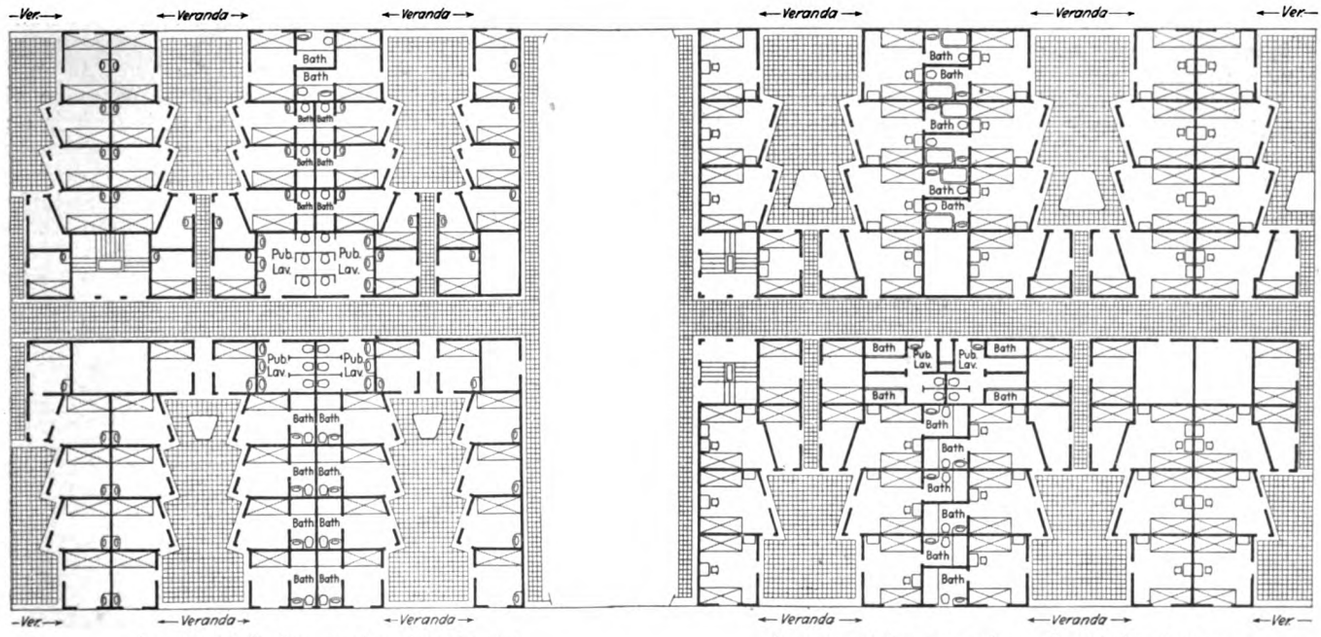
Fig. 1.—Outboard sketch of after end of bay, sound or river steamer showing arrangement of staterooms and verandas

New System of Passenger Accommodation for Ships

Arrangement of staterooms increases passenger carrying capacity without adding to cost of construction—Each room becomes an outside room

GEORGE G. SHARP, naval architect and consulting engineer, 30 Church street, New York, has developed and patented a new system of passenger accommodation for steamships which not only provides better natural lighting and ventilation for all passengers by making each stateroom an outside room but also increases the earning power of the vessel by providing a greater number of rooms without adding to the cost of construction.

This is accomplished by grouping the staterooms around verandas thus affording ready access to all public spaces



Arrangement for bay, sound or river steamers

Arrangement for ocean-going and coastwise steamers

Fig. 2.—Deck plan showing application of "saw tooth" principle to arrangement of staterooms

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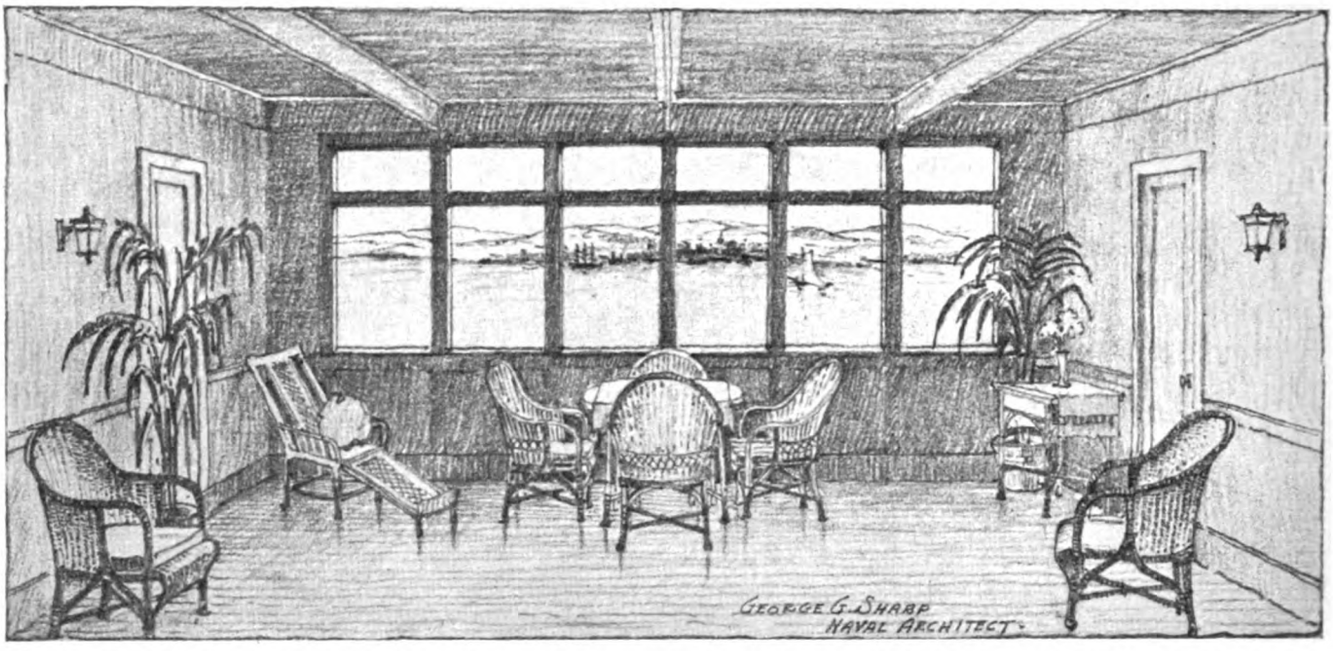

Fig. 3.—Upper veranda enclosed. This arrangement is for the upper decks of ocean-going vessels or the lower decks of inland steamers

on board and, at the same time, providing attractive private lounging deck space for adjoining rooms. This arrangement permits a more economical utilization of the deck space and the elimination of communicating corridors and passageways required in other arrangements. Each stateroom has direct access to a veranda by means of a door and each stateroom is also provided with a window affording a vision of the sea and admitting fresh air through the veranda outboard opening which may be entirely open or enclosed with Beclawat or Laycock windows, shell ports or air ports according to the elevation of the deck and service of the vessel. Another advantage derived from this system is an orderly concentration and consequent economical installation of the ventilating, lighting, heating and various service piping systems. Considered from every point of view, the new system not only offers more comfortable, convenient and attractive quarters for the passengers but also gives the shipowner an opportunity to secure higher returns on his investment in the vessel by increasing its earning power without extra cost in construction.

Fig. 2 illustrates the new system with the stateroom bulkheads arranged on the "saw tooth" principle which is applicable in cases where small staterooms for over-night journeys are required, resulting in a larger number of staterooms relative to the beam of the vessel. The "saw tooth" arrangement is also applicable in the case of ocean-going vessels of great beam where it is practicable to have 8 or more large rooms in the breadth of the vessel. The left hand half of the plan, Fig. 2 shows the arrangement for the smaller rooms for short journeys while the larger rooms for ocean trips are indicated on the right hand half of the plan.

Fig. 4 illustrates the system with the stateroom bulkheads arranged on the "stepped" principle. This is applicable in particular when a relatively small number of large staterooms are desired in proportion to the vessel's beam. The "stepped" principle affords greater veranda width and corresponding greater range of vision from the windows of the staterooms away from the ship's side. This principle can be applied to any number of staterooms as well as the "saw tooth" principle depending upon the veranda space desired or permissible.

Fig. 7 illustrates the application of the system to an intermediate type of ocean-going vessel. Access to the saloons, stairs, public spaces and promenade deck is convenient to all rooms by means of the central passages con-

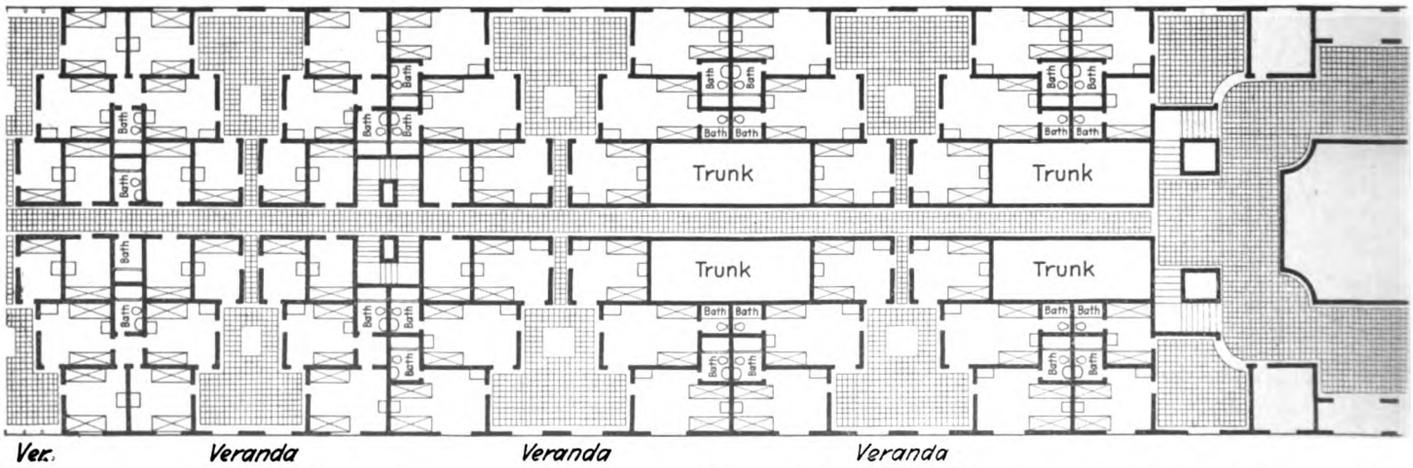

Fig. 4.—Deck plan showing application of "stepped" principle to

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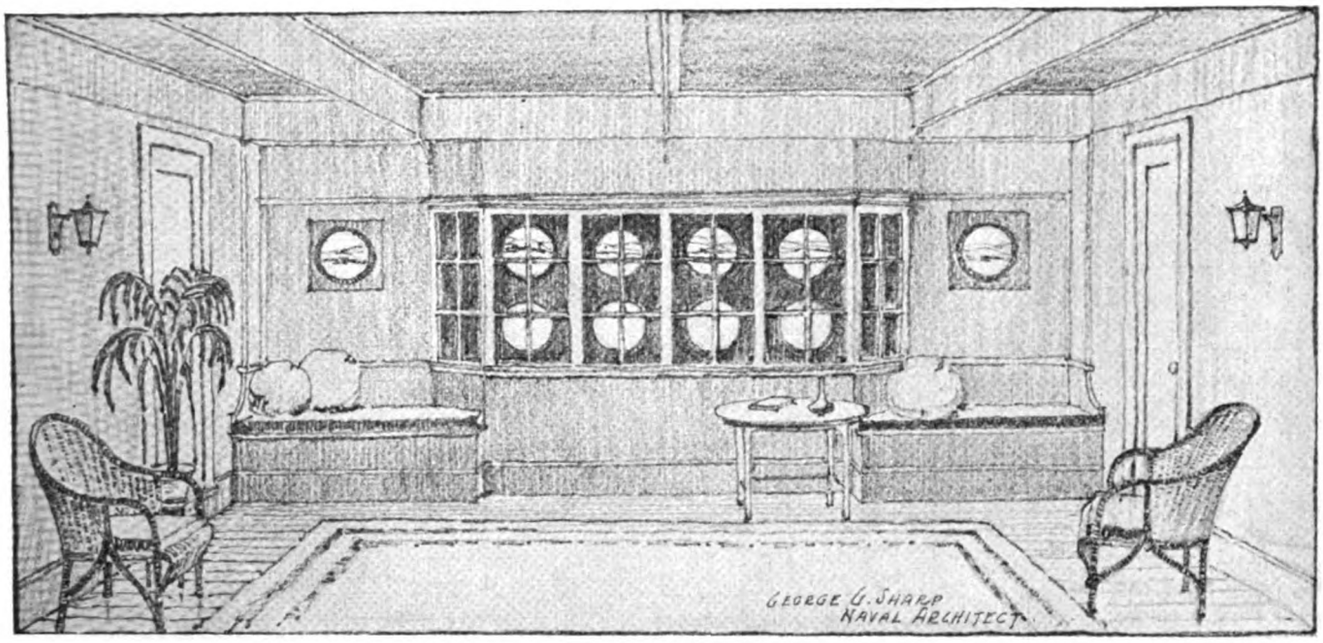


Fig. 5.—Lower veranda with air ports for lower decks of coastwise or ocean-going steamers

necting all verandas. Fig. 8 shows the application of the system to a bay, sound or river steamer where the greatest possible number of staterooms is desired, especially for short journeys.

Figs. 3 and 9 are sketches of upper verandas, the former being enclosed and the latter open as might be desired according to the elevation of the deck and the service or trade in which the vessel plies. When desired the verandas may also be provided with wells which afford a circulation of natural air and light. These are especially desirable when rough or stormy weather might necessitate keeping the outside shell openings tightly closed. Figs. 5 and 10 are sketches of lower verandas. These may be arranged with shell openings by means of hinged shell ports or air ports as preferred. In either case the inside sash affords an attractive setting and protection in wet weather without closing the shell openings. Ventilation is available above the sash thereby maintaining a continuous circulation of air in conjunction with the wells. A typical stateroom with a window opening on the veranda is shown in Fig. 6. In the application of the system to a bay, sound or river steamer, as shown in the outboard sketch, Fig. 1, the verandas are open and the outboard finish is carried out by means of the conventional ship's railing.

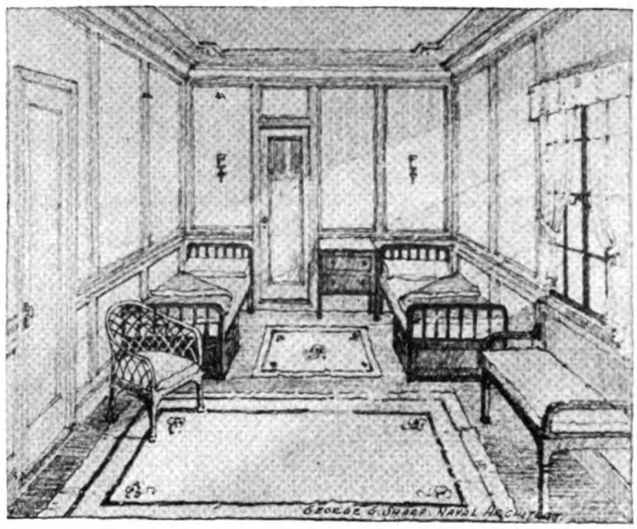
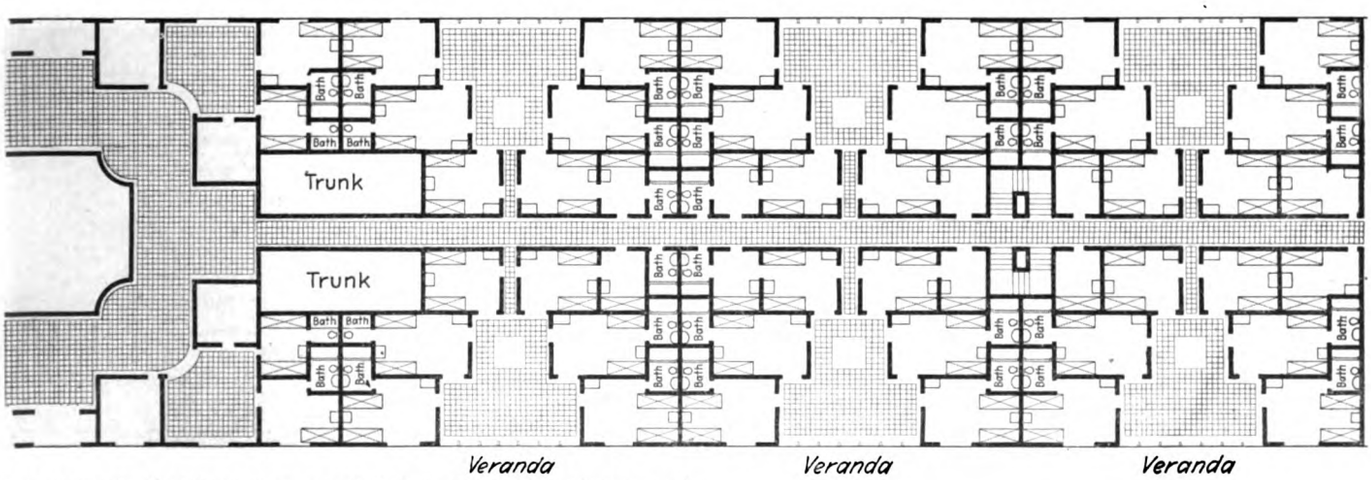


Fig. 6.—Stateroom showing window opening on veranda



arrangement of staterooms on coastwise and ocean-going vessels

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This new system was developed in the endeavor to attain the primary object for which a passenger vessel is constructed; that is, to provide for the comfort and pleasure of the passengers in transit and at the same time to increase the revenue to be derived from this source by the shipowners. In recent years naval architects and shipbuilders have given a great deal of thought to the problem of securing greater economy in vessel operation, probably at the sacrifice of the equally, if not more, important factor of the earning power to be derived from a given space for passenger accommodation. Much has been

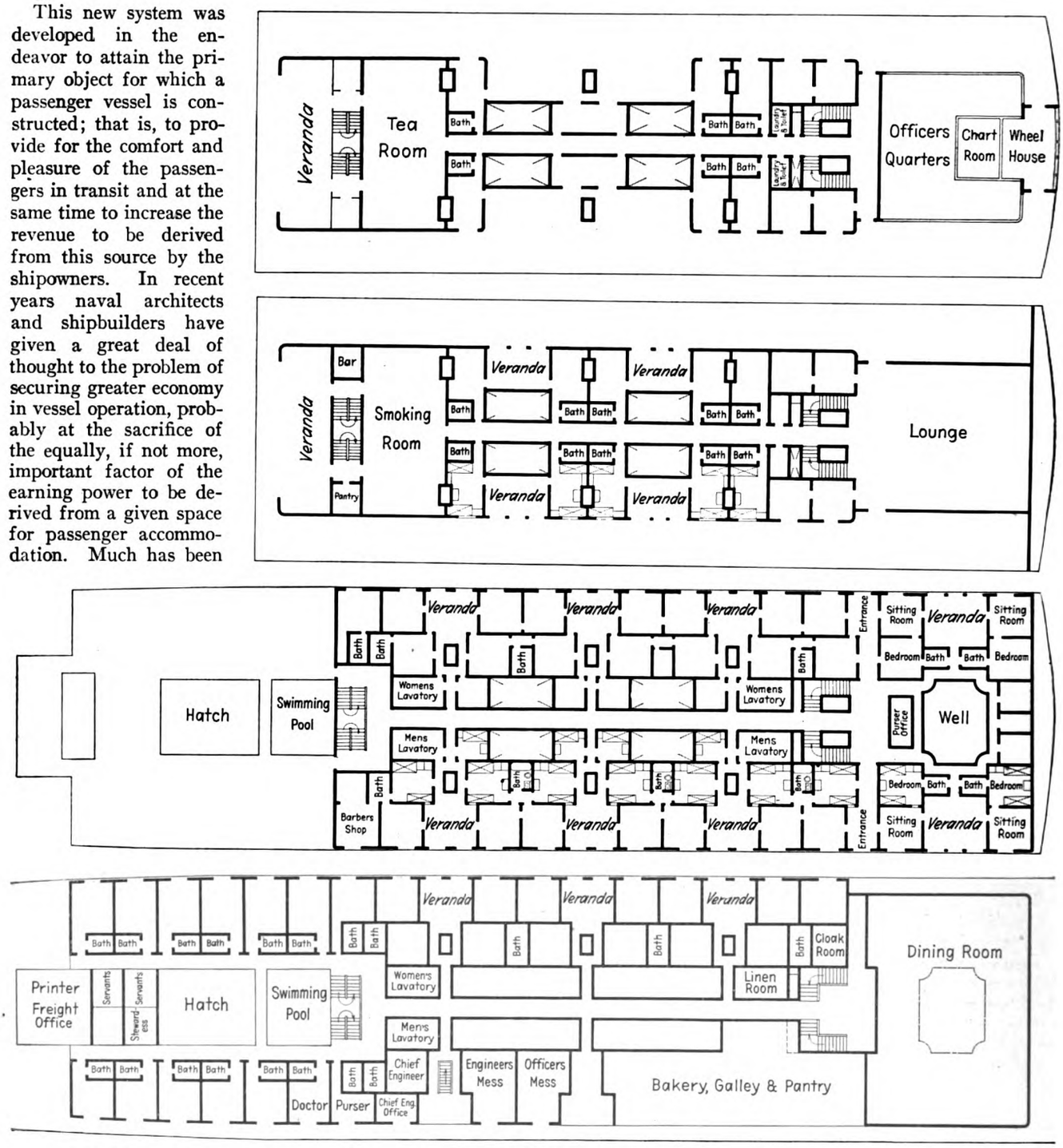

Fig. 7.—General arrangement of passenger accommodations applicable to coastwise and ocean-going vessels

accomplished by tank research and other means in the improvement of ship propulsion. Much has also been accomplished in the provision of more luxurious accommodations to meet the ever increasing demands of the traveling public. While modern vessels are being equipped in a more luxurious manner than formerly, it is questionable whether the demands of the traveler have been anticipated in the marine field to the same extent as in modern hotels and other accommodations on shore. This may be due to the difficulties encountered in providing on a vessel a large number of rooms with direct connection to outside light and ventilation and in providing private bathrooms.

The increasing beam of vessels in recent years has made the problem more acute due to the greater number of inside rooms. The "shut-in" feeling of travel in an inside stateroom is an admitted objection. To many people it is so offensive that they prefer to postpone a trip rather than suffer the discomfort of inside accommodation. For travel in the tropics or semi-tropical climates, the inside room is most undesirable. Hitherto some progress has been made towards developing arrangements whereby the passengers might have more or less direct access to natural light and ventilation as is the case with the system of construction developed and patented by Mr. Bibby. In this arrangement, however, the advantages have been obtained at a sacrifice of space due to a duplication of communicating corridors and to passageways within the stateroom extending to the outside of the vessel.

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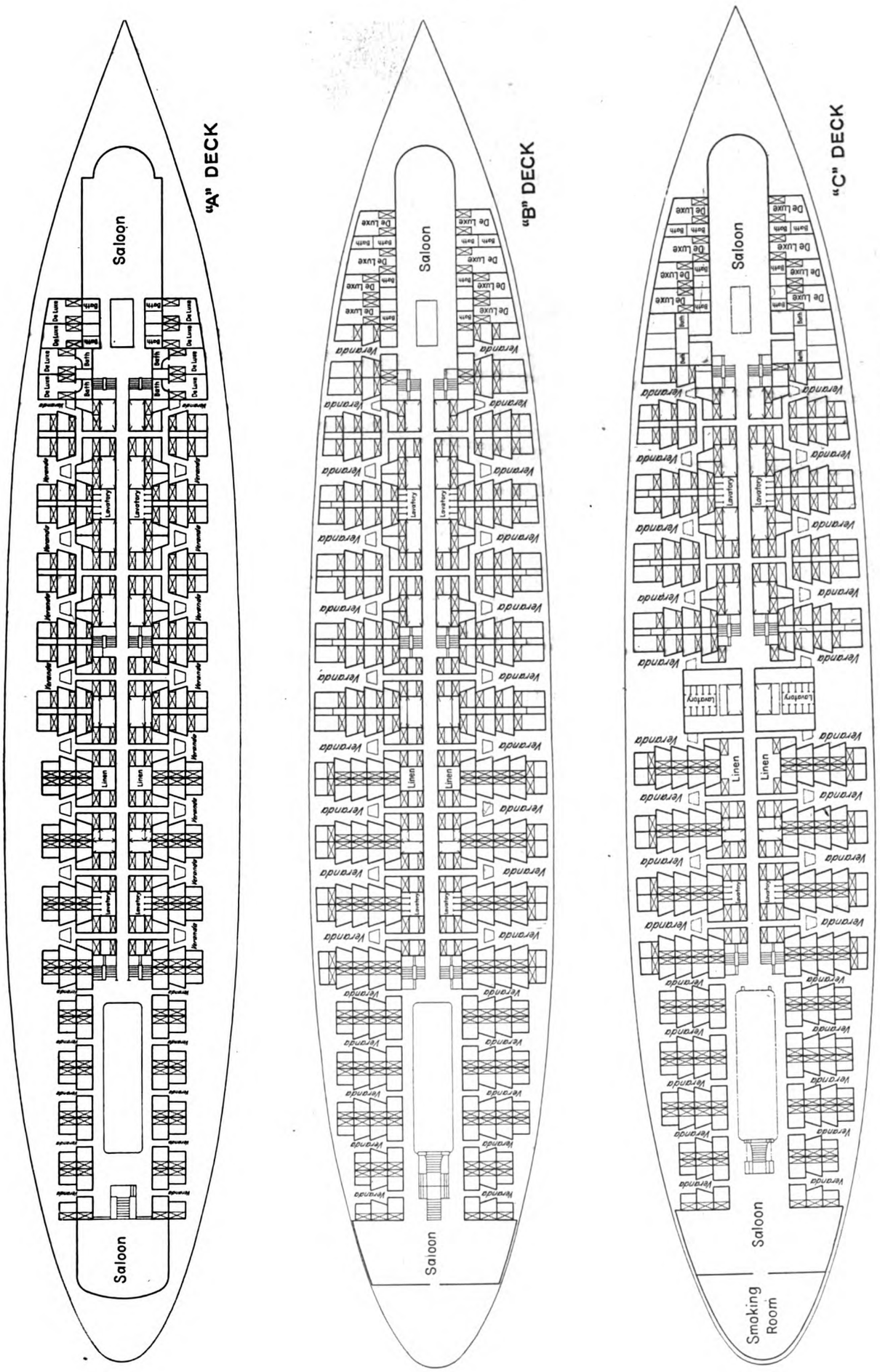

Fig. 8.—General arrangement of passenger accommodations applicable to bay, sound or river steamers

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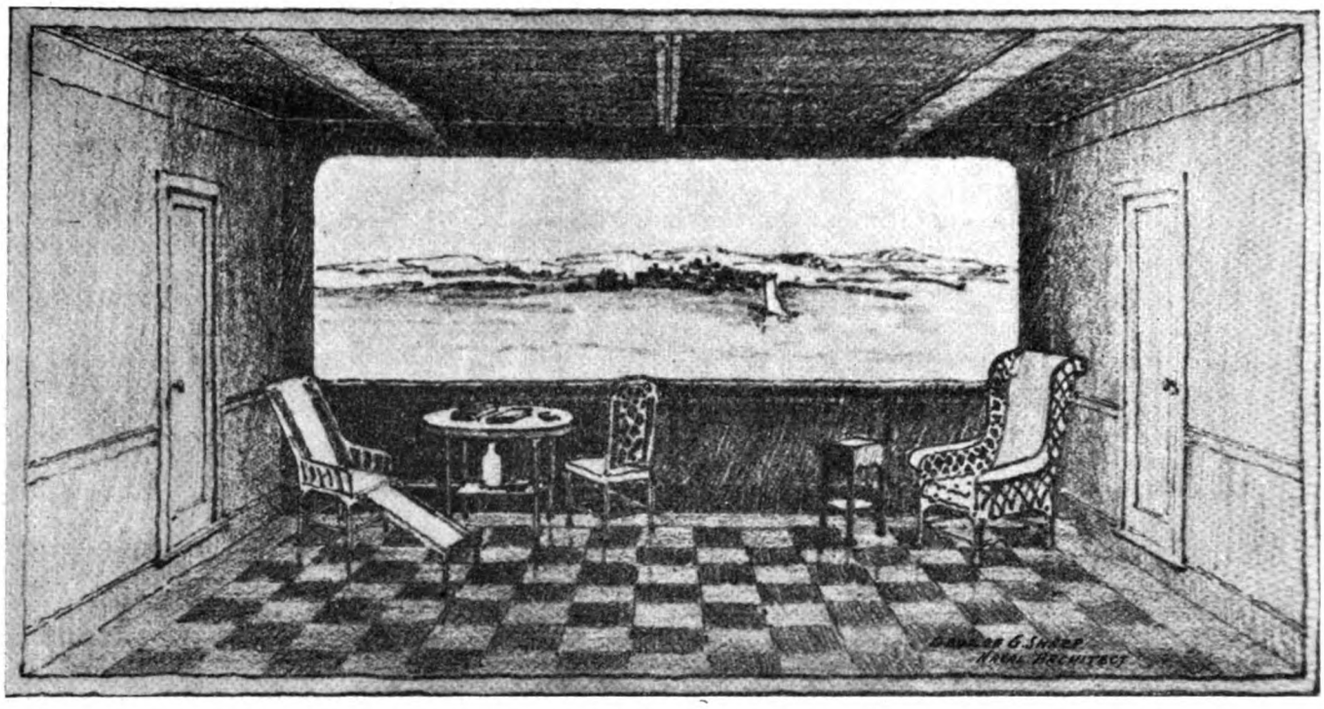

Fig. 9.—Upper veranda open, for upper decks. A drop curtain is provided for wet weather

Although the object sought is accomplished, the inside corridor space is of little value to the useful area of the room and in addition considerably more bulkheading is required than would normally be the case.

In the new system developed by Mr. Sharp, however, these objectionable features have been eliminated and it appears to offer far better results than any system yet advanced from the point of view of both the traveler and the shipowner. It has been worked out in such an orderly and intelligent manner that the wastes of other systems have been eliminated and the earning power of the vessel is increased without increase of construction costs. In fact, the systematic orderliness and concentration of ventilating and piping systems and the like, together with the reduction of bulkheading, give every indication of increased economy in construction.

Williams Bolt-Threading Machine

A BOLT-THREADING and cutting machine of the geared-head type, particularly designed for production, has just been placed on the market by the Williams Tool Corporation, Erie, Pa. The machine

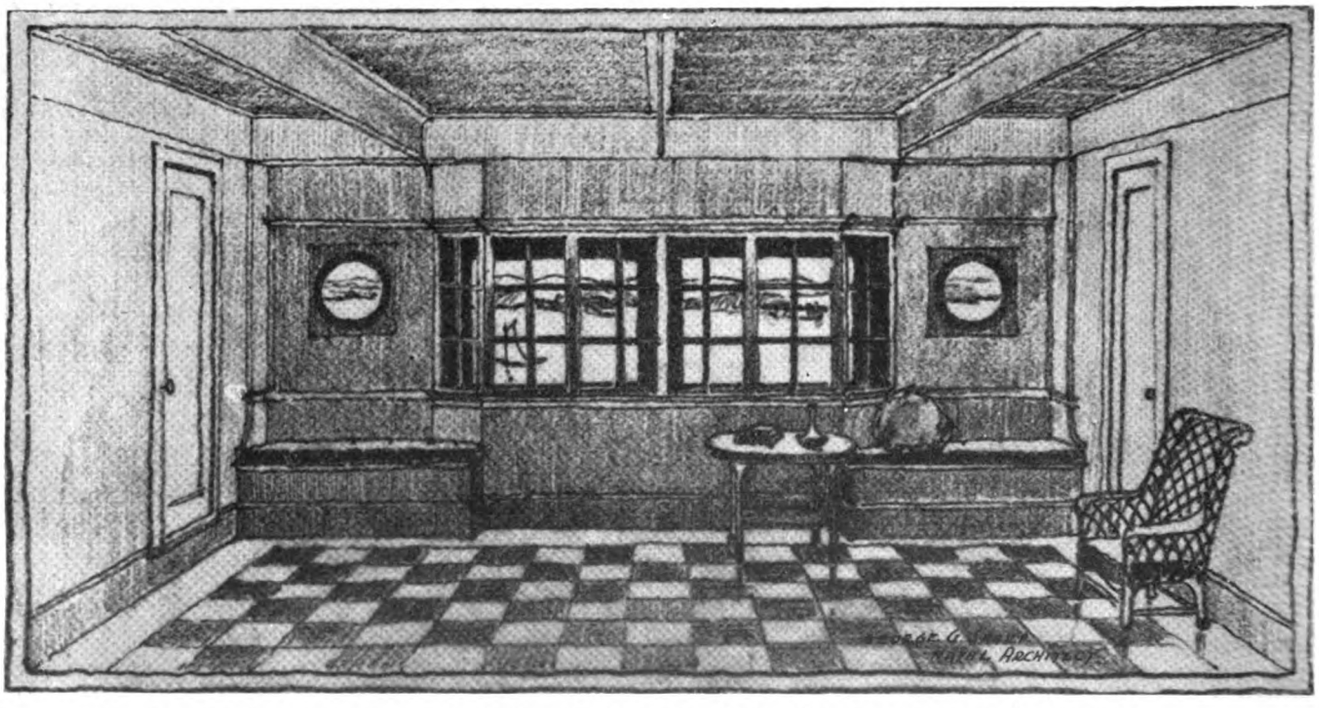

Fig. 10.—Lower veranda with shell ports, for lower decks of ocean and coastwise steamers

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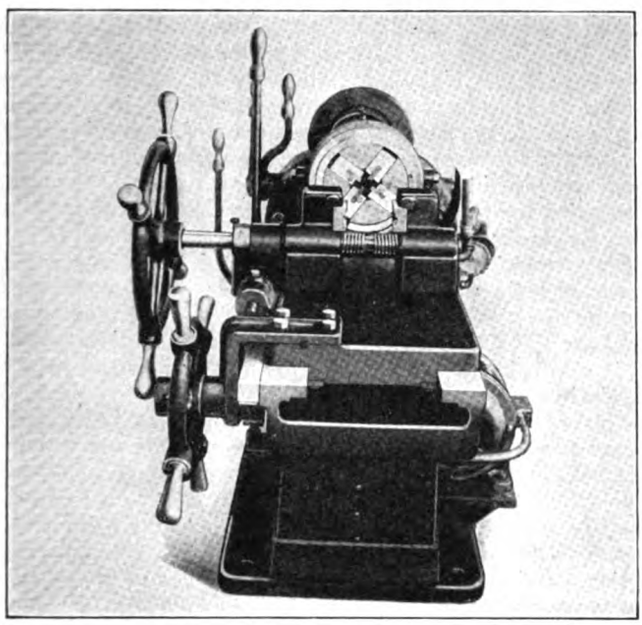
is compact and follows the modern trend of machine-tool design by having the motor at the base instead of above.

The machine uses large die holders to support small renewable dies of high speed steel. The large die holders do not have to be removed from the head in order to change dies. Neither is there any special head adjustment needed, except for the actual fitting of the thread that is to be cut. The size of the thread desired is taken care of by the length of the dies. To cut a different size thread, the operator can

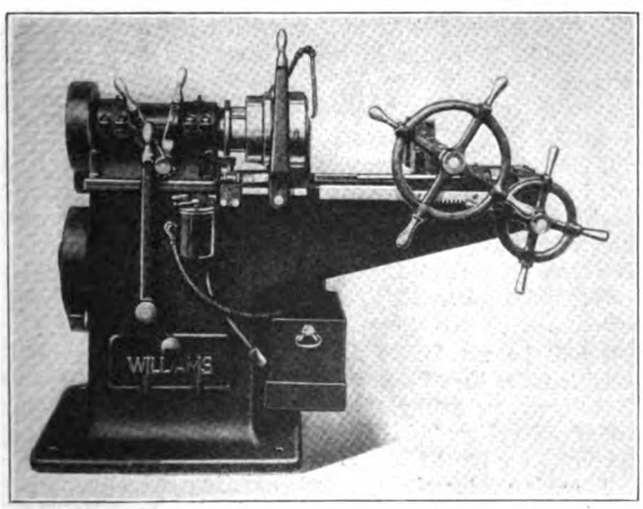


A large die holder is used to support the small renewable dies

quickly change dies simply by loosening the locking screw and taking the die from the holder.

Dies are furnished ⅜ inch to 1½ inches, inclusive, for the 1½ inch machines and ½ inch to 2 inches, inclusive, for the 2-inch machines. Nut taps are also furnished within the same range.

The operator has complete control of the machine from one position and can get seven different speeds by operating



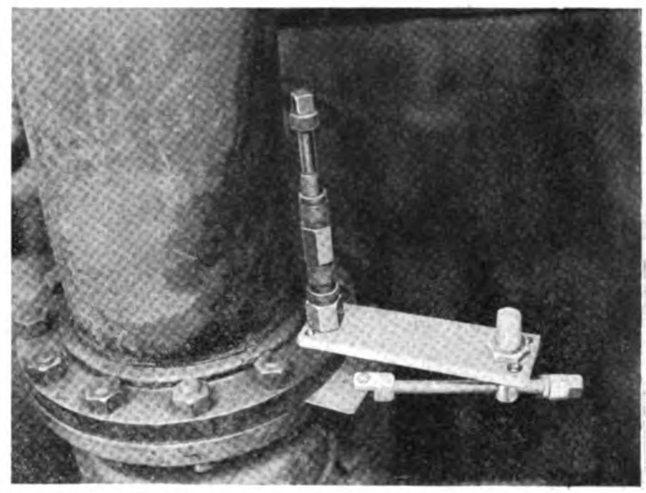
Front view of the Williams bolt threader

only two levers. To change gears, it is only necessary to ease out on the clutch which permits the placing of one or both gear shift levers. A speed plate back of the levers gives the correct position for each size of bolt. Another feature of the machine is the simplicity of the automatic die head.

A New Method of Dealing with Steam Leaks

Furmanite gives promise of a wide range of usefulness

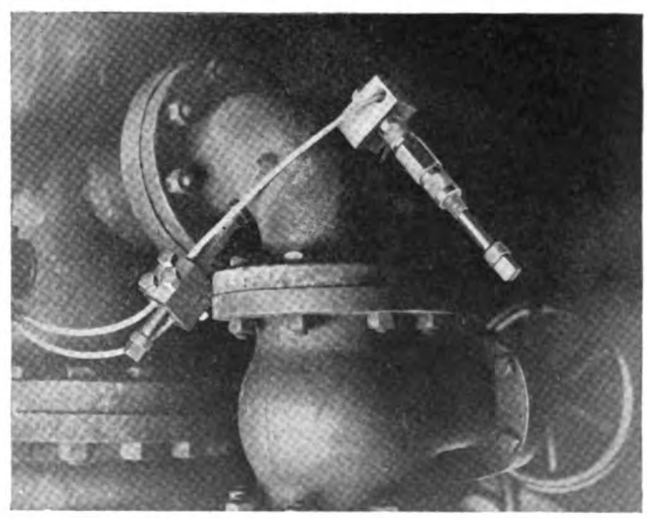
IN our April, 1926, issue mention was made of a new method of closing steam leaks when under pressure, the invention of Mr. E. C. Furman of Newport News, Va. The new leak stopper was exhibited, among other specialties manufactured at the plant of the Newport News Shipbuild-



Stopping leak in flange joint

ing & Dry Dock Company, at the time of the multiple launching which took place at the Virginia shipyard in March.

All leaks are a source of loss which, particularly in high pressure steam plants, may easily assume serious proportions. Any method which gives promise of efficiently stopping leaks without taking down pipes, breaking flanges



Sealing leak through blow hole, sand hole or porous place

and connections or even taking the pressure off the system concerned is certainly very much worth while and worthy of serious consideration and investigation by everyone having to do with units carrying steam, compressed air, water or other fluids commonly used in industrial plants or on board ship.

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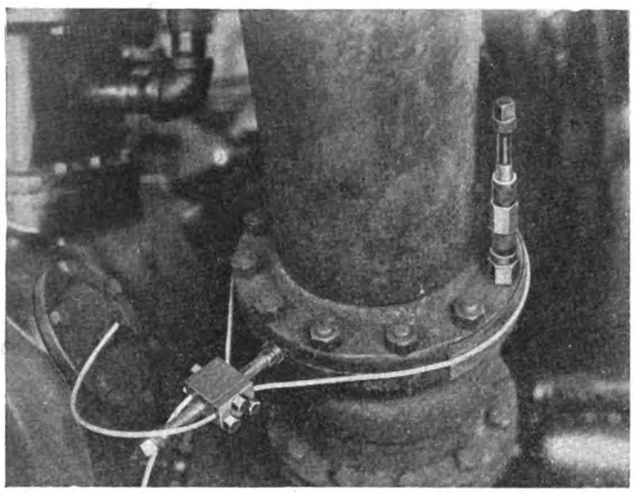
The Furmanite leak sealing compound, as the new leak stopper is termed, is manufactured in solid form but when heated is reduced to the consistency of glue or thin putty. In this condition it is forced by means of a device similar to an ordinary putty gun into the leak or space which it is desired to close where, the heating being continued, it quickly vulcanizes, forming a solid and impenetrable substance entirely filling and stopping up the cavity into which it has been forced. In the case of a flanged joint it forms, in effect, a new gasket molded to fit every inequality of the flange surfaces and making a solid, leakless joint. It should be noted that the Furmanite is not a cement or metallic composition, but is wholly a packing compound, its leak



Second method of stopping leak in flange joint

In this method a strip of sheet lead is held securely over the leak by a cable tightening device for preventing the external escape of the leak sealing compound. This method is easy to use and often is advantageous where space is restricted.

stopping properties being due not only to the fact that in semi-liquid form it is forced into every minute crevice of the metal with which it comes in contact, a property which it shares with a liquid cement, but mainly to the fact that after being injected it vulcanizes in place and becomes an immovable and practically indestructible part of the original joint.

While the effectiveness of such a material, once it is in place, is obvious enough, the difficulty of efficiently injecting it into the various and often inaccessible places where leaks may occur is at once apparent. To overcome this difficulty an ingenious outfit has been devised by means of which leaks in all standard bolted flanges, pipe joints and fittings up to 24-inch pipe size for moderate pressure and 18-inch for extra heavy fittings may be dealt with. The equipment has a wide range of usefulness and may be employed to seal leaks in cylinder head gaskets of engines, compressors and pumps and in bolted connections on tanks and other pressure containers. By means of special injectors which are included in the outfit small leaks through blow holes, sand holes and porous spots in valve bodies, cylinders, turbine casings and other similar castings may be effectively dealt with.

The illustrations indicate the general method followed, variation from the set-up shown being made as required for each particular case. In a flange joint the nut on the bolt nearest the leak is taken off and a Furmanite nozzle is screwed on to this bolt in place of the nut which was removed. The Furmanite gun is then connected to this nozzle, and a curved baffle plate is held over the leak to prevent external escape of the compound which is forced into the leak by the Furmanite pressure gun. For a cast elbow, or other similar fitting, blocks are provided which cover the leak and are held in place by wire rope and screws, the gun being attached to the block and delivering the Furmanite through a hole in the block and thence into the leak.

Furmanite is now in use in a number of the largest industrial plants and considered a regular and essential part of their power house equipment. Its main value lies, of course, in the fact that through its use leaks can be remedied without shutting down the plant or any portion of it. As an example of this, the following is cited: Prior to the installation of the Furmanite service the power house of the Newport News Shipbuilding and Dry Dock Company was shut down regularly twice a year for re-making leaking joints. Since the new method was adopted, something over 18 months ago, the steam pressure has not once been cut off from any pipe in order to stop leaks and the superintendent states that the power house is in better condition as regards tight joints than it has been for years.

Furmanite is being used by the United States Navy Department both on warships afloat and in the Navy Yards. Among the merchant vessels on which the equipment is used are the *Leviathan, President Roosevelt* and *Republic*. It is also being used in many steel mills, industrial plants and railroads in the United States.

One of the comparatively new uses which have been found for Furmanite leak sealing compound is for sealing the bolted flange joints of turbine casings by forcing the compound into a groove cut in the contacting joint surfaces both in new and old turbines and particularly in cases where the joint surfaces have been damaged through corrosion, erosion or otherwise. In a number of cases this treatment has resulted in a surprising increase in the vacuum which may be maintained.

The new leak stopping material and the special apparatus for applying it are manufactured by the Furmanite Corporation of Newport News, Va.

Salt Water Draft of Vessels Transiting the Panama Canal in 1926

DURING the calendar year 1926, the average salt water draft of 2,843 commercial transits of the Panama Canal from the Atlantic to the Pacific was 20.8 feet. From the Pacific to the Atlantic, the average draft of 2,577 commercial transits was 24.6 feet. The average draft of the total commercial transits during the year, 5,420, was 22.6 feet.

The vessels of the greatest draft were the *Amerikaland* and the *Chilore,* carrying cargoes of iron ore from Chile to the United States, drawing 34 feet 6 inches. From the Atlantic to the Pacific, the vessel of the greatest draft was the *Manchuria,* carrying general cargo in the United States intercoastal trade. This vessel had a draft of 33 feet 6 inches.

It will be noted that the average draft of the vessels transiting the Canal from the Pacific to the Atlantic was 3.8 feet greater than the average draft of vessels passing through the Canal in the opposite direction. This is accounted for by the fact that the Pacific to Atlantic traffic is made up largely of vessels carrying capacity cargoes of mineral oils, iron ore, wheat, and other bulk products, while the Atlantic to Pacific products is composed largely of vessels carrying miscellaneous manufactured goods which either are essentially not so heavy or else do not permit the fullest use of the stowage space of the vessel. Also, by far the greater proportion of the transits of vessels in ballast are included, as shown by the records, in the Atlantic to Pacific traffic.

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Pulverized Coal for Marine Purposes*

Resumé of the progress made in the adoption of pulverized coal on board ship

By C. J. Jefferson†

WHY should the use of pulverized fuel on ship board be developed? What are the differences between a power plant at sea and one on the shore that requires this development work? These two questions, in brief, cover the problem that was put up to the Fuel Conservation Committee of the Shipping Board about a year ago.

Why should pulverized fuel be made sea going? Because when it has learned sea going ways and learns how to behave itself in a marine plant, it will then effect economies in the operating costs of our existing vessels of such a magnitude that an auditor's statement can be a real pleasure instead of simply "a study in scarlet."

Why Use Pulverized Fuel

Oil fuel is ideal in many ways for steam generation, but it is absolutely criminal to use it for that purpose when the same results can be obtained from a much cheaper and more plentiful type of fuel. All engineers have known this for years, it is no new teaching, but when they calculated the difference in efficiency which the average plant would attain with oil as compared with coal, and when they tried to sign on satisfactory fireroom crews and found that year after year it has become increasingly difficult to obtain men with sufficient intestinal fortitude to swing on a slice bar and at the same time have enough savvy to care about saving B.T.U.'s, then they were inclined to let their engineering instinct and scruples go by the board and join the criminal band of oil burners.

Those of you who have fought for steam pressure, when rolling some thirty degrees or more with the wheel kicking out, and hell in general broke loose down below, know what it means to drive men when the heat of the fires is burning up the human part of their minds, and you too agree that the man who substitutes fuel oil for coal should be called blessed.

But, if the boiler efficiencies obtained with oil can be duplicated, and if this duplication can be accomplished in such a way that the operating problem is no greater than that on the oil burner, and if all of this can be done with a fuel that has a B.T.U. cost approximately one-half of that of fuel oil, then it behooves the marine engineering fraternity to bestir itself and find out whether or not this type of power can not be put to work on ship board.

That is the reason why the Fuel Conservation Committee decided to tackle the problem, for pulverized fuel has on numerous shore plants met the conditions just cited.

But, if this has been worked out on shore, why should there be any marine installation problem?

The answer to this is simply furnace design.

In the average pulverized fuel plant, where the rate of combustion has been less than a pound of fuel per cubic foot of furnace volume, deep or long furnaces have been used, which allowed flame travel of 20 feet, or more, which permitted comparatively slow flame propagation, or ignition of the individual particles of coal.

This type of furnace design is not practical on ship board, and in the case of the Scotch marine boiler, it is not only impractical but impossible. The furnace of a Scotch boiler may be made smaller, by installation of refractory lining, by accumulation of ashes and dirt, or by the collapse of the furnace, but it just cannot be made larger, it's not that sort of animal, and when you consider the present existing vessels of the merchant marine, you have got to consider Scotch boilers, because the large majority of them are fitted with this old-time reliable but inflexible type of steam generator.

Conditions to be Met in Scotch Boiler Furnace

The furnace of the ordinary Scotch boiler is approximately 8 feet long up to the combustion chamber, which is about 3 feet deep, giving a total maximum length of flame travel of 11 feet.

In fact, this should be reduced to about 10 feet, as impingement of the flame against rear sheet of combustion chamber must be avoided. This gives you one phase of the problem. You are required to cut the length of your flame in half, as compared to the ordinary shore plant.

The combustion space in a three-furnace separate combustion chamber type of Scotch boiler of 2,500 square feet heating surface, which is the typical type of boiler found on the average cargo carrier, will be somewhat less than 500 cubic feet. In order to burn 2,000 pounds of coal per hour in these furnaces, you must burn 4 pounds of coal per cubic foot, or approximately twice as much as the maximum rate, or eight times as much as the average rate attempted in the shore plant, and all this must be done in a completely water cooled furnace without the benefit of stored up heat found in the refractories of the large furnaces of the job on the beach. Therefore, the development work that was necessary to produce satisfactory land installations must be carried on to a much greater degree of refinement before pulverized fuel can don its sea togs.

Why Early Experiments Failed

Back in 1921, the idea of pulverized fuel for marine purposes, especially for use in Scotch boilers, was advocated and an attempt was made at the Fleet Corporation Test Plant at Chester to adopt one of the typical stream line type of burner installations, such as were then and are now used with satisfactory results in shore plants.

A stream line burner is simply a nozzle, with round or elongated opening, through which the pulverized coal is discharged into the furnace by low air pressure, the balance of the air required for combustion being admitted through shutter fitted slots in the furnace front. This is the simplest type of pulverized fuel burner, and if the furnace is sufficiently large, and it is possible to have from 20 to 25 feet flame travel, this type of burner is fairly successful with comparatively coarse coal.

However, the Scotch boiler does not have the large combustion space, nor is 20 feet flame travel possible, and therefore these initial tests made with the stream line burner were not at all successful. The maximum rate of combustion that could be obtained was 2.5 pounds of coal per cubic foot of furnace volume, or a heat release of 32,000 B.T.U. per hour per cubic foot of furnace, and the efficiency of boiler performance was only 54 percent.

The writer, who was one of the participants of these

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* Paper read before technical committee and members of the American Steamship Owners Association on November 19, 1926.

† Head of Fuel Conservation Section, Merchant Fleet Corporation, United States Shipping Board.

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tests, could not work up any enthusiasm regarding these results and became a member in good standing of "The Criminal Order of Oil Burners." In fact, advocates of pulverized fuel for marine plants were given but little tolerance for the next few years after these tests.

In the meantime, however, the manufacturers of pulverized fuel equipment were not standing still. They realized that the enormous furnace required for satisfactory combustion was a severe handicap in their competition with stoker installations, and the problem of reducing furnace volume became a serious consideration, so that by 1925 several devices were developed which shortened the length of flame considerably and permitted material reduction in the furnace volumes.

This brought up the question of marine installations again, and after studying the results that had been obtained on shore plants the Fuel Conservation Committee were convinced that further possible progress made along these same lines would eventually develop a combination of equipment which would be entirely practical for marine use and would permit the economies in the marine plant that are today being obtained on shore.

The Diesel Challenge

At almost the same time, further stimulus was given to the question by the numerous Diesel installations which have been made in the fleets of our foreign competitors.

The fuel economy possible in a Diesel installation would drive steam off the seas, if it were not for the high initial cost of Dieselization. This high cost has retarded Dieselization considerably but has by no means stopped it, and the steam men have been forced into developing their equipment so as to reduce the differential in the operating fuel cost between the Diesel and the steam plant.

High pressure, high temperature steam has received a considerable impetus and, with the reinforcement of pulverized fuel, it is possible to meet the challenge of the Diesel, not in terms of pounds of fuel per shaft horsepower, it is true, but in the terms which decide whether a business is profitable or not, that is, in the cost per shaft horsepower developed, and this with a plant whose initial cost will be materially less than that of the Diesel.

We must always keep in mind that there are a lot of ships afloat today, and the operating costs of these ships to the average shipowner is just as important, if not more so, than the operating cost of new tonnage. It is for this class of ships that the successful solution of the pulverized fuel problem offers the greatest salvation.

These facts were all considered by the Fuel Conservation Committee, and they decided that they would tackle the problem. Therefore, arrangements were made with the Bureau of Engineering of the U. S. Navy, that a series of development tests should be made at the Fuel Test Plant at Philadelphia, using pulverized fuel in a Scotch boiler, which was furnished by the Shipping Board from one of the vessels of the laid-up fleet.

Development Tests Started at Philadelphia

The service given by the U. S. Navy to the merchant marine in carrying out these tests is just another example of the service that a trained military organization can give to their country in times of peace as well as in times of war.

The first type of burner selected for test was not chosen so much from its characteristics of being a practical marine type, for as a matter of fact it had several marked disadvantages from this point of view in its state of development as submitted for test, but rather it was chosen to determine the combustion conditions that could be obtained from a burner which was the direct antithesis of the stream line type of burner.

This burner was the Fuller Lehigh Well type arranged in a vertical plane and consisted of four nozzles, so arranged that the stream of coal, together with the air necessary for combustion, from each of these nozzles would cut the stream issuing from the adjacent nozzle, in this way setting up a terrific turbulence.

This type of burner has all of the air necessary for combustion used as primary or carrying air, and any attempt to regulate the air supply would have a direct effect on the turbulence produced, and also, inasmuch as an air swept ball type of mill was used to pulverize the coal, it would have a direct effect on the fineness of the coal delivered.

Results of Tests With Fuller Lehigh Burner

The boiler used for these tests was not fitted with either air heaters or superheaters, while the boiler used with the stream line burner in 1921 had both of these accessories to improve the boiler performance, yet these latter tests showed a remarkable advance in performance, as may be noted from the fact that combustion rates as high as 6.19 pounds per cubic foot of furnace volume were obtained with a release of 88,330 B.T.U. per cubic foot, and a boiler efficiency of 68.7 percent was obtained from the boiler itself, without the aid of either air heaters or superheaters.

At the termination of these tests, an air heater has been installed, as it was apparent from these tests that all measures should be taken to speed up flame propagation, and one of the means of accomplishing this end is to have the air necessary for combustion heated to as high a temperature as possible before it enters the furnace. The use of heated air in the pulverizer mill also reduces the variable in the fineness of the coal caused by moisture in the fuel.

The question of uniform quality of coal of sufficient fineness to insure satisfactory ignition and complete combustion is of paramount importance in connection with the use of pulverized fuel in marine boilers, just as is the case in regard to the correct viscosity of fuel oil. In the shore station, a much wider latitude in degree of fineness is permissible, inasmuch as in the large volume furnace with the long flame travel the coarser particles of the fuel may be ignited further along in the flame travel, and while in the earlier part of the flame the efficiency of combustion may be relatively low, this is compensated for by completion of the combustion in the latter stages.

In the marine boiler, this is not permissible, the limited length of flame travel making it imperative that complete ignition take place as soon as possible and that efficient combustion start at the very early stages.

Peabody Burner Now Under Test

The present equipment that is under test is the Peabody burner, which is a turbulent burner using both primary and secondary air. The primary air carries the coal to the furnace under comparatively low air pressure and it enters the furnace with the coal through an annular slot in a snail shaped casting located at the mouth of the furnace. This arrangement is, in effect, an infinite number of nozzles directing a coal stream against the stream from another infinite number of nozzles. These infinite number of streams cutting each other produce a violent turbulence which is further increased by the admission of the secondary air at the center of the burner.

Official tests have not been completed with this installation, but the preliminary operating runs which have been made indicate a still further advance in the progress of the development of pulverized fuel for marine purposes. In fact, the results obtained show that the original ideal of 80 percent boiler efficiency in continuous operation when operating the boiler at 150 percent rating is entirely feasible.

The reason for setting this overload clause in the program is based on the fact that the average cargo carrier has three boilers, and it is desired to operate the vessel on two

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boilers only, thereby permitting the third boiler to be cleaned while the vessel is at sea and so maintain at all times clean fire and water sides in all three boilers instead of waiting until the vessel arrives in port and then cleaning the three boilers. If the latter procedure is followed, a vessel may start out on a voyage with all three boilers clean but on the return leg of the voyage, at a time when bottom conditions are apt to be considerably worse than at the start of the voyage, especially on long runs in tropical seas, the boilers will be comparatively dirty and so aggravate the harder steaming conditions caused by the increased load due to foul bottom.

Pulverized fuel for marine purposes has gone through a considerable amount of the development work which will make it real sea going, but it is not quite ready to shove off. However, it does give most encouraging prospects, and it is safe to say that within a comparatively short time the marine engineer, in studying his operating costs, is going to be forced to consider another competition against the hand fired coal or the oil burning steam plant—a competition which will also question the superiority of the Diesel's operating costs and will have the advantage of a reasonable initial installation charge.

Monel Metal*

Its Influence on Ship and Engine Design

THE great interest aroused by the publication of the details of the high pressure turbine steamship *King George V.*,† and the important part which monel metal is known to have played in the construction of the propelling machinery of that vessel, have created a desire on the part of many readers for more information concerning this somewhat unique engineering material. There seems no doubt that, if the latest practical developments and present experimental data prove anything, they go to confirm the view previously held that the advent of monel metal opens up a vista of new possibilities in the field of high temperature steam design, with great advance in final terms of high efficiency and reduced running costs.

In these days, when the balance of advantage between the steam engine and the internal combustion motor swings so evenly that experts are divided as to which type of propelling machinery to put forward for many classes of ships, any factor permitting higher steam temperatures, and consequently greater efficiency, may be decisive, and must certainly be examined very carefully.

Fuel consumption per brake horsepower per hour is a vital factor, and the performances given in Table I may be taken as typical.

TABLE I.—FUEL PER BRAKE HORSEPOWER PER HOUR

Type of Engine	Coal, pounds	Oil, pounds
Diesel engines	....	.4
Quadruple expansion reciprocating engines	1.25	...
Quadruple expansion reciprocating engines exhausting into low pressure turbines	.87	...
Turbines with steam at 250 pounds per square inch	.95	.71
Land power station turbines—steam at 720 degrees F. and 550 pounds per square inch	.72	...

To obtain the greatly increased economy effected by the use of highly superheated steam under the limitations imposed on board ship, without sacrifice of safety and reliability, was the problem which confronted the designers of the *King George V.*, and on the success of this step towards higher steam pressures future developments may be said to hinge. The vessel carries not only the greatest steam pressure (550 pounds per square inch) but also the highest superheat (750 degrees F.) yet adopted on any ship.

* From an article by a special correspondent in *The Shipbuilder*, January, 1927.

† See MARINE ENGINEERING AND SHIPPING AGE, October, 1926.

The makers of the turbines and boilers—The Parsons Marine Steam Turbine Company, Ltd., and Messrs. Yarrow & Company, Limited—have naturally used every resource at their command to make their respective units as durable and as safe as the exacting requirements of ocean-going ships demand. It is, therefore, instructive to note that the vital moving and controlling parts in the boilers, steam line and turbines are made of monel metal. This material is used for the valves, valve seats and spindles both on the Yarrow high pressure boilers and the steam line, as well as for the turbine blades and shrouding on (*a*) the high pressure ahead turbine, (*b*) the first and second intermediate pressure turbines on both sides, and (*c*) the astern impulse blading. Lastly, it may be added that monel metal condenser tubes are fitted in one of the surface condensers.

The reasons for this extensive adoption of monel metal lie in its combined qualities of resistance to corrosion and

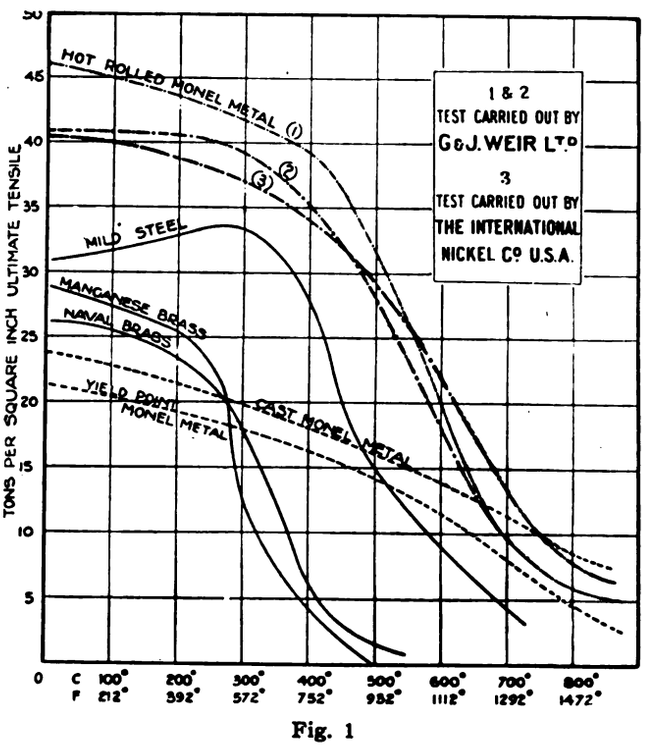

Fig. 1

strength at high temperatures. In the very active search for corrosion resisting materials which the modern engineer so assiduously pursues, a material is welcome where such valuable qualities are intrinsic and do not depend on heat treatment or surface finish. That this is true of monel metal is explained by its composition, which, for practical purposes, may be given as two-thirds nickel and one-third copper.

The further valuable quality of strength at high temperature is best exhibited in the diagram given in Fig. 1, in which the strength of several engineering metals are charted at various temperatures. The tests were carried out in a standard testing machine. The specimens were raised to and held for 30 minutes at each particular temperature without load, and were then broken at the usual speeds.

At 750 degrees F.—the crucial temperature in steam practice today—it will be noted that the relative strengths are as follows:

Monel metal	35 tons per square inch
Mild steel	28 tons per square inch
Brass	5 tons per square inch

Further tests carried out at the National Physical Laboratory on actual turbine blading, as drawn and supplied commercially, gave the results stated in Table II.

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Table II.—Tests on Turbine Blading

	At 60 degrees F.	At 750 degrees F.
Ultimate stress	41.9 tons per square inch	36.4 tons per square inch
Yield point	37.7 tons per square inch	31.2 tons per square inch
Elongation on 2 inch..	24 percent	16.5 percent
Reduction of area.....	60 percent	60 percent

In addition to strength, however, the ideal turbine blading must be able to withstand heavy vibration, and even shock, without breaking. It is important to note that monel metal is one of the toughest metals known. In the Izod testing machine it has withstood an impact of 115 foot-pounds without rupture—a performance only equalled by the softest of wrought iron. This toughness has been strikingly exhibited in service on more than one occasion when mishaps have befallen turbines containing both monel metal and bronze blades. The former have been straightened out cold and replaced; while the latter, when not actually fractured, have been so severely damaged as to require complete replacement.

Resistance to Wear and Tear

As for wear and tear, attention may be drawn to the photograph reproduced in Fig. 2, which shows the monel-metal turbine blading of one of Messrs. Weir's high speed

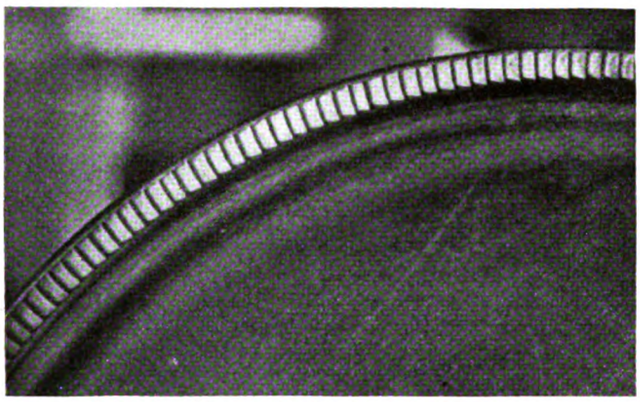

Fig. 2.—Monel metal turbine blading after 6 years' continuous service

feed pumps. This photograph was taken during an overhaul after six years' continuous service in a French power station under a pressure of 227.5 pounds per square inch and a temperature of 660 degrees F. The blades are reported to be almost as good as when new, and the turbine is now back at work and fit for many years' further duty.

If, therefore, monel metal gives in the *King George V*, the same effective service as it has already given in many of the largest power stations, there will be a general demand for increased superheats and greater pressures among that large circle of marine engineers who still pin their faith to steam.

To keep these remarks in proper perspective, readers may be reminded that in the post-war refit of the liner *Leviathan*, prior to her being put into the transatlantic commercial service, no less than 25,000 pounds of monel metal was employed. This great quantity ranged over literally every phase of the engine room's paramount requirements; it also included the domestic side of the ship's activities—pantry and galley equipment, table and counter tops, hot plates and artistic finger plates—and even the operating table in the surgeon's quarters. The power of monel metal to withstand the serious corrosive action of salt water has long been well known, and equally its resistance to the effects of sea-laden atmospheres. It will be readily appreciated, therefore, how advantageous is its adoption on board ship where such conditions are practically ever present.

This precedent—already followed by leading steamship lines, including the Canadian Pacific Railway Company and the Cunard Steamship Company—has been developed in the *King George V*. Here monel metal sheet is used in the galleys and pantries for sinks, table tops, hot presses, cooking ranges, etc., made by Messrs. Buchanan, of Greenock, and in the hotwater boilers supplied by Messrs. Stott, of Oldham. Such a wide variety of applications was only made after careful scrutiny of the economies to be effected in maintenance and cost of cleaning, and of the value of the more ornamental and hygienic results to be obtained.

Monel Metal Condenser Tubes

All connected with shipping will await with more than ordinary interest the results of the test of the monel metal condenser tubes installed in the *King George V*. The ship's equipment in this respect will permit of the most instructive comparisons being drawn. The importance of reliable condenser tubes cannot be exaggerated in ships where superheated steam is used. The smallest leak will raise the salinity of the feed water to a dangerously destructive level, and perhaps there is no field where greater room for improvement exists than in the metal for condenser tubes. The requisites for such a material are well known, and, so far as recent tests reveal, monel metal gives promise of "coming out on top," now that the production has been carried to the commercial stage and solid drawn tubes of fine gage are available. In the severe conditions of service obtaining in Mediterranean waters, they have given surprisingly encouraging results. In one case, where Admiralty brass tubes had previously lasted only 6 to 8 months, monel metal tubes, of thinner gage, have already been in use for over 2½ years and show no signs of failure. A notable point is the reduction in weight possible. Twenty-gage, and in some cases even 21-gage, can be substituted for 18-gage brass tubes—a saving of at least 25 percent in deadweight.

The far-reaching influence of a material having such universal application cannot be overlooked by those who design or own ships, whether their interest lies in the propelling machinery or in all that pertains to the comfort of passengers and crew. How far this influence will extend cannot yet be stated, for the commercial development of monel metal still continues. Other developments of great technical interest are now emerging from the semi-experimental stage; and when results are sealed with the record of commercial service achieved, it is hoped—by the courtesy of Messers. G. & J. Weir, Limited, who supplied some of the foregoing data—to give further particulars.

(Photograph from Keystone View Co., Inc., of N. Y.)

Comes ashore standing up

A few feet more and the five-masted schooner *Nancy* would have invaded the trolley tracks at Nantasket, Mass. The *Nancy* was on her way to Norfolk.

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Oil Engines Inadvertently Damaged With Salt Water

Leaky seam admits salt water to fuel oil tank causing extensive damage to exhaust valves and cylinder heads

By A. B. Newell

A FEW years ago the owners of a motorship made a heavy weather damage claim, contending that a number of cracked cylinder heads and badly worn wrist pin bearings had resulted from the vessel encountering a terrific storm and starting a seam in the fore deep fuel tank. The insurance adjusters at first maintained that it was a preposterous claim. They admitted that the hull had been damaged and agreed to make that good, but, as far as the engines were concerned they stated most emphatically that there was nothing doing. However, the owners proved to their complete satisfaction that the cracked cylinder heads did actually result from the leaking fuel tank and the claim was payed.

This merely serves to prove that the source of trouble may be far removed from its termination and lack of experience sometimes results in the numerous failures to attach the correct sequel to events that at first glance appear inconsequential. It was so in this case. The tank leaked, the ship pitched and rolled, sea water and fuel threshed around together in the tank until an emulsion was formed and the salt water went into suspension in the fuel. With all due respect to persons making claims for existing processes such as heating, settling, centrifuging and whatever others there may be, the fact remains that there is no method of removing all of the moisture from fuel oil aboard ship no matter what is done and such moisture will carry salt. A prominent chemist in one of the large oil refineries states, "If it could be done, we would immediately uncap a number of Mexican oil wells that are sealed on account of salt water. In the present state of our enlightenment it can not be done economically in an oil refinery and it would be entirely impossible aboard ship." In considering this matter it should be remembered that there is a vast difference between water in suspension and free water in fuel oil. The latter may be extracted with little difficulty, while the former can not.

Water in Suspension in the Fuel Oil

This appeared to be very much the case on the ship in question, for the engineers employed every practical method of separating the salt water from the fuel but to no avail. Since there was no other fuel aboard they had to burn what was there. It burned, the water evaporated during combustion and the salt melted. In passing over the exhaust valves with the exhaust gases, the dusty particles of molten salt impinged upon the seats and built up a hard crust which shortly cracked and let the valves leak. The engines were stopped time after time while valves were being removed and standby sets put in. The trouble finally became so bad that it was either a case of burn up a few exhaust valves or stop both engines at one time while the storm raged. The captain sagely objected to letting his ship get out of control and the chief agreed to sacrifice a few valves. The leaking, fire-spitting valves caused the cylinder head to heat excessively in the immediate vicinity of the exhaust valve cages which in turn resulted in undue local expansion and cracks. The ship ran to port, the chief knew what the condition of the engines was, or probably was, opened them up and revealed the damage. Then started a long discussion which terminated as I have already indicated.

Simultaneous with the damage to the valves and cylinder heads the cylinder walls were being coated with salt which the rings picked up. Also the orifices in the flame plates eroded rapidly causing incorrect atomization and poor combustion. The engines were of the trunk piston type and the wrist pins were lubricated with oil scraped off the cylinder walls. Since the cylinder lubrication was in a deplorable state of mixture with soot and salt the wrist pin bearings suffered badly and that point was also proven. However, at the present moment many capable engineers who have not passed through a similar experience will declare that it is no-such-thing, that it did not occur, that it could not occur—yet it did.

Not believing it they are not careful about thoroughly clearing double bottom tanks of sea water ballast before using the same tanks for fuel and they experience some difficulty with exhaust valves which they charge variously to sulphur, rust, sand or some other improbable contamination of the fuel or to poor material in the valves. In time they learn that their surmise had been wrong, particularly with regard to the great hob-goblin sulphur which is mostly hocus-pocus.

Salt Water a Savage Enemy

Salt water strikes unexpectedly with savage blows. This question of its mixture with fuel has been explained too many times to be treated in detail but in other respects it has received less attention. It is hitting cylinder liners from below.

Several large motorships have had to renew cylinder liners and it was commonly believed that the trouble lay in the inadequacy of American foundry work, or material. The manufacturers of certain of these engines were loath to make a frank statement of the trouble lest they call additional attention to the fact that their engines had been working poorly. They felt also that excuses are commonly taken with a grain of salt, even though they be excellent ones, therefore they held their counsel and renewed the liners with as little publicity as possible.

I must respect the confidence placed in me by the chief engineer of one plant, to whom I am indebted for some of the information I have gathered pertaining to this subject, by not naming the firm. They failed to produce tight jointed telescopic tubes for the piston cooling service and a certain amount of salt water spray, very fine spray to be sure, was constantly being sprinkled into the lower end of the cylinder liner where it was picked up by the rings and carried up the cylinder walls. It appeared to do more harm at the top of the liner than at the bottom.

I am unable to state definitely why this proved to be the case but surmise that the salt in reaching the top of the liner encountered a minimum of lubrication and maximum of heat and pressure whereas at the lower end, even though the quantity of salt was greater, there was more lubrication, less heat and temperature and less damage. With a maximum of wear near the top of the cylinder, salt water entering the bottom seemed to be a wholly improbable solution of the problem but practice demonstrated that, all theory to the contrary, such was the case.

It happens that there were several ships with identical

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engines and on one of them the cylinder liners did not wear. The chief engineer of this ship was an ingenious and foresighted sort of chap and he improvised a sort of hemp and tallow pack which he lay about the stuffing boxes on the tubes to prevent the spray from rising. He devoted himself religiously to maintaining this pack and woe betide the watch engineer who permitted it to become out of kilter. He was accused of being a "dam' crank" but he got results and no doubt contributed a valuable service to the Diesel engine manufacturing fraternity in general since he demonstrated that salt water spray entering the lower end of the cylinder liner would damage the entire cylinder.

Analogous with this experience is that with a smaller two cycle engine in which the cast iron core plugs in the lower end of the cylinder jacket were in communication with the scavenging air chamber. The cooling water service pipes on that engine were of brass and a galvanic action set up and ate away these plugs until they started to leak. Sea water dripped into the scavenging air chamber and was passed along to the working cylinders with the air. Even though the amount of water was not sufficient to stop combustion the salt rapidly wore the cylinder liners and destroyed the rings. The leak was out of sight and it took some time to locate the trouble. When it was located new plugs were fitted and zinc elements installed to prevent further galvanic action. With the elimination of salt water in the cylinders, wear and ring trouble stopped.

Examples such as I have given are more numerous than is commonly known. Almost every motorship engineer can relate a tale of some peculiar salt water trouble or damage and a very common complaint is lubricating oil contamination. All of this leads us to believe, or should lead us to believe, that we are still entirely too careless about the way we handle salt water. If there is any chance of encountering such difficulties, and there is, we should not forget that one or two major repair bills will more than pay for the cost of providing complete and perfect protection against any and all forms of salt water damage.

What Is Wrong with the Marine Condenser?*

A Problem Still to Be Solved

IF the superintending engineer of any of the prominent British or Continental steamship companies responsible for the operation of modern, high powered, turbine driven steamers were asked what section of the propelling machinery was productive of the greatest measure of apprehension and anxiety he would in all probability reply, without hesitation, the condenser. The recurring failure of condenser tubes in high powered passenger vessels constitutes one of the most unsatisfactory features of ship operation today, and despite the enormous amount of research which has been devoted to the subject, the problem appears to be as far from solution as ever.

An alarming feature of condenser troubles is that the tube failures have occurred more particularly in high vacuum, geared turbine steamers in many instances during the first few months of their service. What this means in anxiety and expense to the owner and/or the builder may be gathered when it is stated that a large number of post-war passenger liners have had to have their condensers entirely retubed within 18 months, and in a few cases within 12 months, of their trial trip.

The opinion is held by some superintendents that high vacuum is largely responsible for the alarmingly short life of the tubes. Others again blame the tube manufacturer, and suggest that the quality of the material in the tubes is not what it should be. In support of both of these views the superintendent is able to point to the fact that within his own fleet there are several intermediate, reciprocating engined, pre-war steamers operating with condenser tubes which have functioned with complete immunity from trouble for periods ranging from 15 to 20 years. The tube maker, on the other hand, disposes fairly satisfactorily of the view that high vacuum should have any bearing whatever on the question by submitting that it should be physically impossible for a condenser tube which passes a works test of 1,000 pounds per square inch pressure to fail solely on account of the 10 to 15 percent higher vacuum carried on the modern, geared turbine vessel. The increase from the 25-26 inch vacuum normally carried on reciprocating engines to the 29½ inches of the turbine offers, he submits, no constructive basis for approaching the problem.

He maintains, furthermore, that greater care has never been exercised in tube manufacture than in the last few years, and that the cause of tube failures must be sought elsewhere. One of the most fertile sources of trouble, in his opinion, is the admission of air to the interior of the tube, and as a means to avoiding this he suggests that the end waterways of the condenser should be made of more ample volume. There is much to be said for this view, as in modern machinery installations with geared turbines space considerations frequently result in the end waterways of the condenser being seriously restricted, particularly in underslung condensers, where it is often a matter of difficulty to secure adequate free end space to withdraw or insert the full length tube. The result of these restricted waterways is to set up turbulence, and to create air pockets in the cooling water before it actually reaches the tube.

As an off-set to the restricted condenser dimensions a very high velocity of cooling water flow is frequently adopted, and this, again, encourages the formation of air pockets, which experience has shown are extremely detrimental to the life of the average condenser tube.

An embarrassing feature of condenser troubles is that there are no two cases alike, and a corrective which may appear to be efficient in one case is of no avail in another. In a large twin screw steamer owned by a German company considerable trouble was experienced with condenser tube failures, and as this vessel was fitted with the single wire electric lighting system, using the shell of the ship as the dynamo return, this was thought to be a possible cause of the trouble. In a later vessel, fitted with the two wire lighting system, tube failures were also experienced, and a special electrolytic device was installed to counteract the supposed galvanic action.

A peculiar circumstance in connection with the foregoing is that galvanic action was considered to be the cause of the trouble in one case, while in the other case efforts were actually made to induce a form of galvanic or electrolytic action as a possible corrective. The majority of German owners favor the tinning of condenser tubes, both inside and outside, and in some vessels the inner surface of the tubes has been coated with a fine film of lead. In regard to the latter, it should be stated that unless very great care is exercised to ensure that a perfectly homogeneous lead film is deposited local interruptions are liable to occur, and experience has shown that rapid deterioration of the tube invariably takes place at such points.

The same objections are liable to attend the spraying of the interior of the tubes with solution—a practice which, however, has been successfully carried out by the Cunard Line. The success of this method would appear to depend upon the inner surface of the tubes being rendered slightly rough before application of the solution, and this roughness may be secured either by subjecting the tubes to a brief period of service beforehand, or by other mechanical means. A further fertile source of tube failures is the exertion of

*From the Liverpool *Journal of Commerce*.

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undue pressure on the tube end when screwing home the ferrule to compress the packing. After many years of research into failures from this cause, the United States Navy has abandoned entirely the use of soft lace packing in favor of the purely metallic packing. An additional advantage of metallic packing is that the tube and the tube plate are at all times maintained in perfect metallic contact.

A practice adopted by several British owners in order to ensure metallic contact between tube and tube plate is to insert lead rings at the base of the ferrule stuffing box. The action of screwing up the ferrule serves to flatten the lead ring and to secure the desired metal-to-metal contact. As a further aid to the prevention of turbulence and the formation of air pockets in the inlet waterway, bellmouth ferrules have in many cases been fitted. An objection to the bellmouth ferrule, however, is that the hollowing-out of the outer end of the body of the ferrule to give an easy converging entrance to the cooling water results in reducing the strength of the ferrule at the point where the driving slots are cut. When screwing up such ferrules or adjusting them it is found that breakages are liable to occur.

In spite of the great variety of methods devised to correct condenser troubles, tube failures still persist, and while the majority of the vessels in which trouble has been experienced are fitted with the cylindrical Scotch boiler, where a small proportion of salt is not vital, it is obvious that the reliability of the condenser where the more vulnerable watertube boiler is fitted is a matter of the greatest importance. The phenomenal progress made by the marine Diesel engine has recently, and for the first time, placed the steam engine in a defensive position, and the modern trend of steam engineering progress would appear to indicate that the most promising avenue of attack on the Diesel performance is through the medium of much higher steam pressures and temperatures.

Without looking very far ahead, it is easy to perceive that the general adoption of very high boiler pressures will eliminate the large cylindrical Scotch boiler entirely in favor of the watertube boiler, with its small diameter steam and water drums, which can be manufactured to carry pressures of 600 pounds per square inch and over, in perfect safety. It is apparent, therefore, that the dependability of the condenser will assume much greater importance in the future than it has done in the past, and the arrangement adopted in the pioneer, high pressure turbine steamer *King George V*, where the condenser has been so designed that a defective section of the tubes may be isolated to permit of the machinery being operated on the remaining tube elements at reduced power, indicates that substantial scope exists for rendering more reliable this very important section of the propelling machinery.

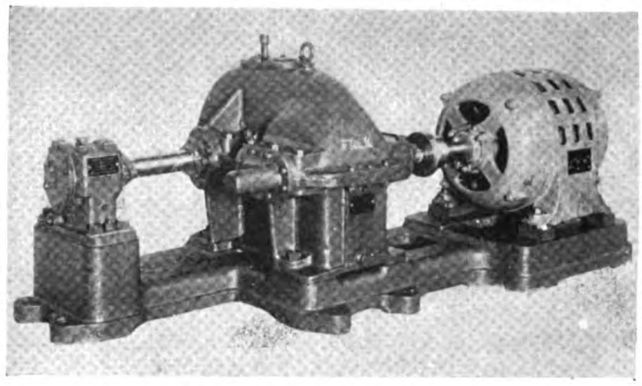
The potentialities of the high pressure, high temperature turbine appear to be so great that the best brains in the country may be depended upon to find a solution for condenser tube failures sooner or later. In the early days of Diesel engine development the recurring failure of cylinder liners and cracked cylinder covers constituted a grave menace to the progress of this prime mover, but superior technique in design and metallurgical science have so combined to solve these problems of heat stresses that today cracked liners and cylinder covers form a very minor part of the operating worries of the superintendent.

Such is the path of engineering progress, and if the condenser designer, the tube manufacturer and the superintendent engineer get together and pool their acquired knowledge and experience, the solution of condenser troubles should not be beyond the power of achievement. There can be no question, however, that until a more reliable marine condenser is somehow evolved, the progress of the high pressure, watertube boilered turbine steamer will be very seriously retarded.

New Falk Speed Reducers

THE Falk Corporation, Milwaukee, Wis., has brought out a new line of speed reducers. These units feature the Falk continuous tooth, all steel herringbone gears. Like the units previously built by this company, the gears are precision made, silent and give high efficiency.

Special design of housing eliminates any internal ribs, projections or complicated cores. Lubrication has in this way been simplified and all possibility of dirt or core sand working into the gears is definitely removed. Added



Falk double reduction unit

features are the airplane type steel-backed, babbitt-lined bearings that are capable of carrying heavier loads and an improved automatic continuous lubrication system.

Based on years of experience, this line covers a certain number of standard reduction ratios. Standard motor beds have been adopted for these units. Standardization of units and beds in accordance with general industrial demands makes possible stock delivery of this precision product.

The reducers are made in three types—single reduction for ratios up to 9:1, double reduction for ratios up to 70:1, and triple reduction for ratios up to 300:1. A double reduction unit No. 7D is shown in the illustration.

Air Driven Portable Hand Saw a Time and Labor Saver

AN automatic portable hand saw, operated by compressed air and doing five times the work of an ordinary saw in the hands of a workman, has been devised by the Ingersoll-Rand Company, 11 Broadway, New York. This saw, it is claimed, reduces sawing costs from 50 to 75 percent below the cost by the old hand saw method.

By a mere shift of blades, the pneumatic hand saw may be put to work in sawing wood, soapstone, Bakelite, wallboard, cables, copper and other materials. Cross-cut or rip blades for different types of work are available. It cuts timber; does trimming work on buildings and scaffolding; and it is used by railroads in car repair work. It is as adaptable in its applications as it is economical in its operation.

In sawing wood, the portable air driven hand saw can be operated 20 times as fast as a workman can ply his saw, and in this, as well as in all other work, it can be operated continuously without fatigue to the operator. Its weight is such that it can be easily carried about and handled by the workman. The 8-inch size weighs only 23 pounds.

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One outstanding feature of this new air saw is its safeguard against accidents. The design combines the Ingersoll-Rand 3-cylinder type of air motor, long in use in I-R grinders and light-weight drills, with the Crowe safety saw guard. This guard has been officially approved by the Ohio Industrial Commission, by the Pennsylvania Department of Labor and Industry, by the New Jersey Department of Labor; and by the Underwriters' Laboratories.

Ripping 4-inch outer planking

The safety guard is of a telescopic nature. It opens when the saw is applied to the material, and it automatically closes and locks in position as the cut is completed.

Cutting 4-inch outer planking

It affords complete protection against accident or damage to the blade.

The saw guard has an adjustable stop so that the saw can be set for the required depth of the cut.

The 3-cylinder air motor is of the balanced type, smooth running and free from breakdowns. All wearing parts, including the cylinders, are renewable. The cost of up-keep of this safety saw is almost negligible.

The saw is being manufactured in three sizes, known as B6, B8 and B12 and takes 6-inch, 8-inch and 12-inch blades, respectively. It is a labor, time and money saver in every field in which it is in use.

Goodrich Research Engineers Convert Rubber Into Lumber

THE B. F. Goodrich Rubber Company comes to the front with another rubber development of outstanding character. A short time ago an announcement was released by them telling of the discovery and development of Vulcalock—a cement-like mixture which causes rubber to stick to metal or wood. And now Goodrich research engineers are converting rubber into lumber.

This new product, which has been called Aeroboard, has been used experimentally in the construction of a few speed boats, pontoons and airplane fuselages. In all such tests it has shown results surpassing wood. Goodrich engineers' reports indicate that the new material can be worked practically the same as wood and in many cases can be worked into difficult rounded or curved shapes much easier than wood. It can be attached to frames with nails or screws without danger of splitting.

Due to the softening characteristic of rubber when heated this material can be molded to difficult shapes when heated to the temperature of boiling water and retains such shape when it is cooled without destruction of any of the original tensile strength of the board.

Rubber has a natural flexibility and the retention of much of this quality in Aeroboard, Goodrich engineers claim, will prove of incalculable benefit in fuselage construction. The stresses set up in an airplane fuselage when landing are more likely to be absorbed and their destructive strains checked or eliminated when the body is of rubber lumber.

In the report of the Goodrich engineers is found evidence of the new material's strength. Tests conducted showed that the rubber lumber withstood strains of great force. In practically all cases the resistance to breakage force was equal to wood of the same thickness and under some conditions the rubber lumber showed itself to be from two to five times stronger than wood.

It possesses a very low moisture absorption quality which naturally recommends the material for light boat construction. Laboratory experiments established the fact that the new material would absorb less than 1 percent of moisture when immersed in water maintained at a temperature of 70 degrees F. for seven weeks.

Rubber naturally resists the corrosive action of sea water, barnacle growths do not attach themselves to it as easily as to wood, and for all practical purposes it has a longer life when exposed to such elements than wood. This latter fact is established by the nature of the material and the manner in which it is vulcanized.

The new material is not being produced in commercial quantities at the present time, but the Goodrich Company is planning on such production at an early date.

THE PROPELLER CLUB GROWS.—In line with the aims of the Propeller Club organized in New York several years ago, Propeller Clubs have recently been started in Boston and New Orleans and an undergraduate Propeller Club has been organized at Yale University. New officers for the Propeller Club of New York recently elected for the coming year are as follows: President, Harry W. Parsons; vice president, E. M. Roberts; secretary, W. Z. Gardner; treasurer, D. L. McFeggans.

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The Practical Analysis of Merchant Ship Trials and Service Performance*

By E. V. Telfer

A SURVEY of the present position of our knowledge of merchant ship performance forcibly reminds us that each vast full-size experiment presented by every completed ship contributes but little to the general science of ship propulsion. An immense field of research remains practically unexplored; and the pursuit of improved efficiency is at present almost entirely in the hands of the model experimenter.

When the ship and model field are comprehensively correlated, the hazard of the latter's extrapolation will be ultimately eliminated. Until the ship field, however, is as thoroughly explored as is that of the model, the hazard of the latter will continue to exist. In the author's opinion, the duty of the ship-field exploration rests with the practitioner.

However willing the practitioner may be to perform this duty, he has a very definite obligation to the experimenter and to science in that, whatever the results of his exploration, it is essential that they represent the truth. The elaboration of his problem *in a commercially practicable manner* forms the subject matter of the present paper, and throughout attention is essentially confined to the slow-speed merchant ship.

Types of Trial

Four distinct tests are, in some cases, carried out on a ship and her engines. With oil engines, a shop test is the usual preliminary. With both steam and oil engines, a quay trial for preliminary examination of the engine installation forms the second test. The third test may take the form of a measured mile trial in the ballast or light condition, while the fourth test is the measured mile trial in the loaded condition. Few ships are, of course, subjected to all of these tests.

So far as ballast trials are concerned, it is probable that the securing of technical information is subordinated to the desire of establishing that the power contracted for is actually developed; the speed realized on the ballast trial is regarded as unimportant. The ballast trial, however, is becoming of greater importance scientifically.

The final test, the load trial, is one whose comparative rarity is such as to make its value fully appreciated by the builder. Generally, every attempt is made to take every observation with all possible care but despite this care, it is very evident that when the results obtained are subjected to any real scrutiny, such as, for example, when correlation with model experiment is attempted, exasperating discrepancies are brought to light.

Measured Mile Trials and Speed Analysis

If we regard the usual measured mile trial as an experiment and contrast its procedure with the methods of the laboratory, the most outstanding difference is the lack of active control of observations. The time on the trial is generally regarded as so limited that the simple expedient of checking a doubtful observation is rarely resorted to, since only after a trial is it realized that a particular observation is at all doubtful.

So far as power data are concerned, progressive checking, in the absence of special instruments, is practically out of the question. The case, however, is different with speed data; and chiefly, but not exclusively, for this reason, the collection and analysis of measured mile data should be considered in the two distinct sections: speed and revolutions data and revolutions and power data.

A vessel goes on trial in tidal waters, and a number of double runs are intended to be made on the measured mile. The first essential to the reviewing of the speed data collected is a prepared diagram having for base, time of day. As the speed for each run is noted, and the number of revolutions per minute (based upon the total revolutions on the mile) is available from the engine room, the revolutions per knot should be immediately calculated and laid off on the time diagram at the correct time of day corresponding to the mid-point of the run. The program of the trial should thus be proceeded with, and through the revolutions per-knot points for the up runs and down runs respectively, fair curves should be passed. Provided the trials have been made at progressively increasing or decreasing revolutions, these revolutions-per-knot-time curves should be fair and any marked discrepancy in the spots

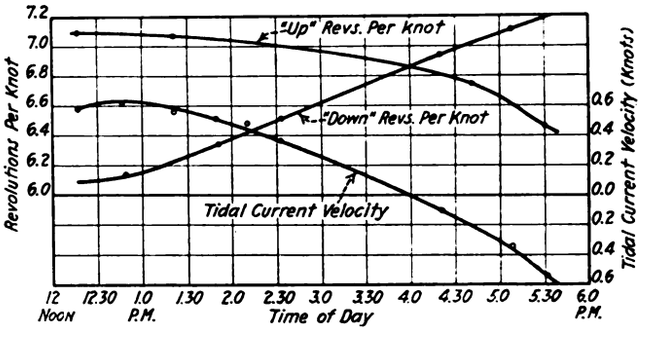

Fig. 1

should generally be sufficient justification for making another double run at the revolutions which are clearly in doubt.

A typical revolutions-per-knot curve is shown in Fig. 1. Due to the sinusoidal nature of the tidal velocity, the respective up and down curves are also sinusoidal. As maxima and minima occur each six hours in the velocity of a purely diurnal tide, the time separation of the respective maxima and minima on either curve should also be six hours. The maximum of the up curve will, of course, occur simultaneously with the minimum of the down curve; at some point between these extremes the curves will intersect. If no prevailing current is present, the point of intersection will be midway along the six-hour range.

The maximum on the revolutions-per-knot curves corresponds to the greatest current against, the minimum to the greatest current with, and the intersection points to zero current. If now we draw in a curve midway between the ordinates enclosed by the up and down curves, this mean curve represents to a first approximation the true revolutions-per-knot curve uninfluenced by tidal velocity. Fundamentally, however, in this analysis it is the variation in tidal velocity that is presumed to be continuous. It follows, therefore, that the inverse mean revolutions-per-knot value should be multiplied by the revolutions per minute at any particular run to obtain the first approximation to

*From a paper read before the North East Coast Institution of Engineers and Shipbuilders.

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the true ship speed. This speed should be deducted from the speed actually obtained on the mile, the resulting differences in velocity set off on a time of day base and faired as a curve of current velocity. From the ordinates of this curve the tide can then finally be read off, and the ship speed on each run unaffected by tide determined.

When the relative weather conditions on each pair of runs are reasonably the same, the ship speeds as above obtained may be reasonably considered as accurate.

It is now of importance to review the present practice of presuming that the mean results of each double run can be taken as indicative of the true performance in tideless waters. This will be facilitated by considering a trial velocity variation following the pure sine form and having a maximum velocity of 2 knots. Fig. 2 shows the curve.

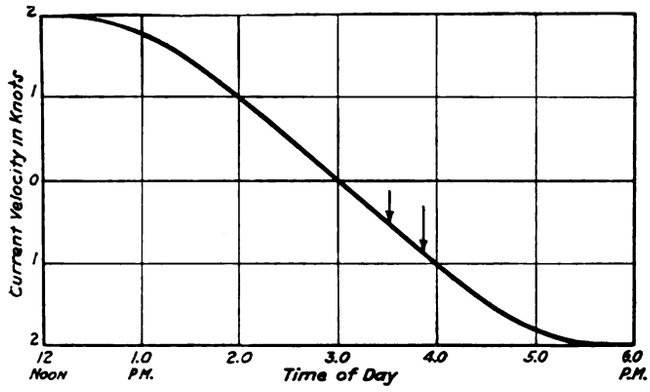

Fig. 2

If we now take an average value of 20 minutes between each run, there exist distinct opportunities for error in the usual method of averaging the speeds found in the up and down runs.

For example, consider the case of two runs made at a time when the tidal velocity is increasing. It is obviously a matter of some importance which run is made first. If the first run is with the weaker current and the second against the stronger, the mean speed so obtained is obviously different from that derived from the reverse method of running. To take a numerical example, let the vessel's true speed through the water be 10 knots in each case. Take the first run with the current at 3.30, the current then being 0.50 knot and hence the apparent speed on the mile 10.50 knots. At 3.50 p.m. the second run is against a current now of 0.90 knot, the apparent speed thus being 9.1 knots. The mean of the two apparent speeds is therefore 9.8 knots, while actually the true speed is 10 knots. Conversely, had the runs been in the reverse directions at the time of day considered, the two apparent speeds would have been 9.5 and 10.9 knots. The apparent mean would thus have been 10.2 knots.

For longer intervals and lower ship speeds the errors may be greater still. For higher speeds the error will be less. As the 10-knot ship constitutes a very important part of the output of this country, and further represents *the* type in which correlation with model work is least complete, the importance of the tidal correction recommended in this section should be obvious.

Measured Mile Trials and Power Analysis

As engine power is a function of engine speed, the results obtained on any trial are best analyzed by neglecting the presence of the ship and merely considering the variation of power with revolutions. This variation can be studied in many ways. Several considerations, however, restrict the choice of method. In the first place, direct correlation of power with revolutions is undesirable, because with zero revolutions the engine power is also zero. This type of correlation does not, therefore, bring out the influence of engine friction; and to avoid this difficulty, mean referred pressure correlation with revolutions is essential. To effect this correlation most reliably, the fundamental relations between the two variables must first be studied. Mean referred pressure is directly proportional to torque; and as the torque of a propeller at constant real slip varies as the square of its revolutions, it follows that the correlation of mean referred pressure and revolutions squared offers a very simple means of studying trial records. Thus, if a base of revolutions squared is prepared, calibrated of course simply in terms of revolutions, mean referred pressures can be set up as ordinates; and, provided first that each record has been taken at constant real propeller slip and, further, that the mean referred pressure necessary to overcome *total* friction is constant, it follows that all the observed mean pressure spots will lie along one straight line, which, extrapolated to zero revolutions will intersect the zero ordinate at some positive quantity representing the mean pressure corresponding to the constant total friction. (See Fig. 3.)

In practice, the condition of constant real slip will rarely be fulfilled. Further, to embody real slip in trial data is to use a quantity which is not directly measurable. Since, however, it is a fair assumption to consider wake fraction to remain constant over the trial range of speed in merchant vessels, constant apparent slip, which is measurable, can be regarded as an indication of constant real slip. In considering power data, therefore, from the standpoint of correlation with revolutions squared, what we are doing fundamentally is to investigate the performance of the propeller as a torsion-dynamometer. The presence and resistance of the ship only act to modify the slip of the dynamometer. It follows, therefore, that the magnitude of the torque absorbed by a propeller depends primarily upon its revolutions and only secondarily upon its slip. This secondary effect of slip is nevertheless of great importance, and any method of analysis adopted must be independent of weather, fouling, resistance, and other causes of slip change. One method which appears to be available for the purpose is that based upon the fact that the only common property of all observations is that they refer to one constant value of wake fraction. This assumption in conjunction with the further assumption that the total engine friction is constant for all engine speeds, enables a simple method of analysis to be adopted, only, however, primarily for trials which are carried out for propellers which are fully immersed.

The Inter-relation of Shop, Quay and Measured Mile Trials

The development of the oil engine has done much to increase our knowledge of the mechanical efficiency of reciprocating engines. An examination of the results of shop trials on marine Diesel engines from the point of view of mechanical efficiency brings out one interesting and curious fact. Many trials show that the difference between the mean indicated and brake effective pressures, representing frictional mean pressure, is reasonably constant despite a fairly wide range of revolutions and brake horsepower. The discrepancies which do occur appear to be more or less erratic, and in the present state of instrumental technique, it would appear rational to adduce from the shop tests the average value of the frictional mean pressure and regard this as a constant quantity *throughout the practical range of working of the engine.*

Accepting this assumption, the shop trial is of definite assistance in reviewing the power data taken on the measured-mile trial. The performance of oil engines seems to

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endorse the view that friction cannot be artificially subdivided into initial and load friction.

In our mean pressure-revolutions-squared diagram we can thus introduce the average mean frictional effective pressure obtained from shop tests, and regard it as the minimum value of the zero-revolutions mean pressure ordinate. Actually, in view of shaft friction, it will be somewhat greater, and if we increase it by about 1 or 2 percent of the maximum normal mean indicated pressure, depending upon the nature and length of the shafting, this modification will correctly allow, in nature, for the variation in shaft transmission efficiency at the lower powers.

In the majority of cases it will be sufficient to adopt the zero revolutions mean pressure ordinate obtained from the shop trial and use this value to obtain the best straight line passing through the measured-mile-trial mean pressures and corresponding to the average apparent slip of all the trial observations. Incidentally, it may be mentioned that for engines of 1,500 to 3,000 indicated horsepower the mean pressure at zero revolutions seems to average about 3 pounds. This value for a maximum *normal* mean referred pressure of 33 to 36 pounds corresponds to a mechanical efficiency of 91 percent. This value was used in preparing the diagram shown in Fig. 3.

The accepting of such a value enables the ballast trial to be analyzed in a similar manner to that alternatively recommended for the load trial. The mean line drawn through the observed mean pressures will emanate from this zero revolutions ordinate, and as before can be labelled with the mean apparent slip of all the constituent observations. It will, of course, be much lower than that derived from the load trial analysis, its precise location depending upon the degree of immersion of the propeller.

From the foregoing it will be evident that only with accurate fundamental data can the measured-mile trial yield a definitely accurate value of frictional mean effective pressure. The shop trial is more definite, but does not take shaft friction into account. There still remains, however, the quay trial to be examined. In this case we have the engine coupled through a long line of shafting to a partially submerged dynamometer, the propeller. In this condition the propeller is always working at one constant slip value, namely, 100 percent, and thus the one disturbing factor of the measured-mile trial, *i.e.*, changing slip, is eliminated from the quay trial. Thus, if power records are taken over the greatest possible range of revolutions and the corresponding mean pressures plotted on a base of revolutions squared, the spots obtained should be definitely along a straight line, which again should intersect the zero revolutions ordinate at the value of the constant frictional mean effective pressure.

To obtain reliable results by this method it would appear advisable to have the propeller at least from 60 to 70 percent immersed, so that a fairly high mean referred pressure will be required at low revolutions, thus ensuring steady running. The numerous published results of tug trials in the German literature of the subject show beyond question, that the quay trial can be used for the purpose of securing reliable data.

Generalization of Load Trial Propeller Power Absorption for Apparent Slips Other Than Basis

The work covered in the foregoing has enabled us to obtain one definite characteristic of the completely submerged propeller as a torsion dynamometer at one constant and average apparent slip.

To return to the actual apparent slips found on the load trial will ultimately be essential; but if we continue to confine our attention to the propeller purely as a power dynamometer, our mean line is capable of simple generalization to other apparent slips than the basis. If we select from available data the model screw most nearly resembling

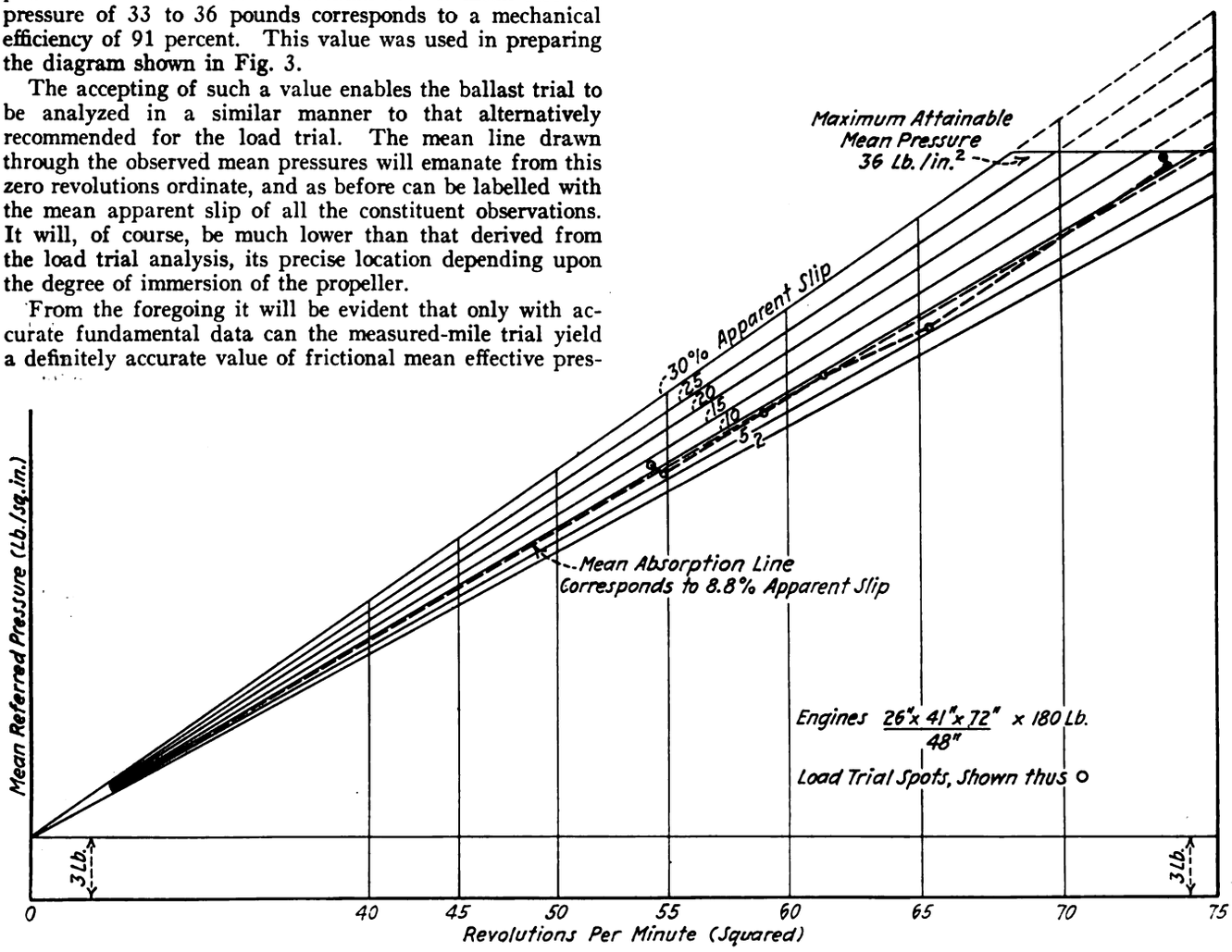

Fig. 3.—Mean referred pressure diagram

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the propeller of the ship under consideration we can, from the basis experiment data, find the variation with real slip of the torque absorption of the model screw. We can now presume this variation to hold good for the ship screw. Thus, from the mean pressure line we can read off the brake mean pressure at any convenient revolutions, calculate the torque constant, and hence from model data read off the

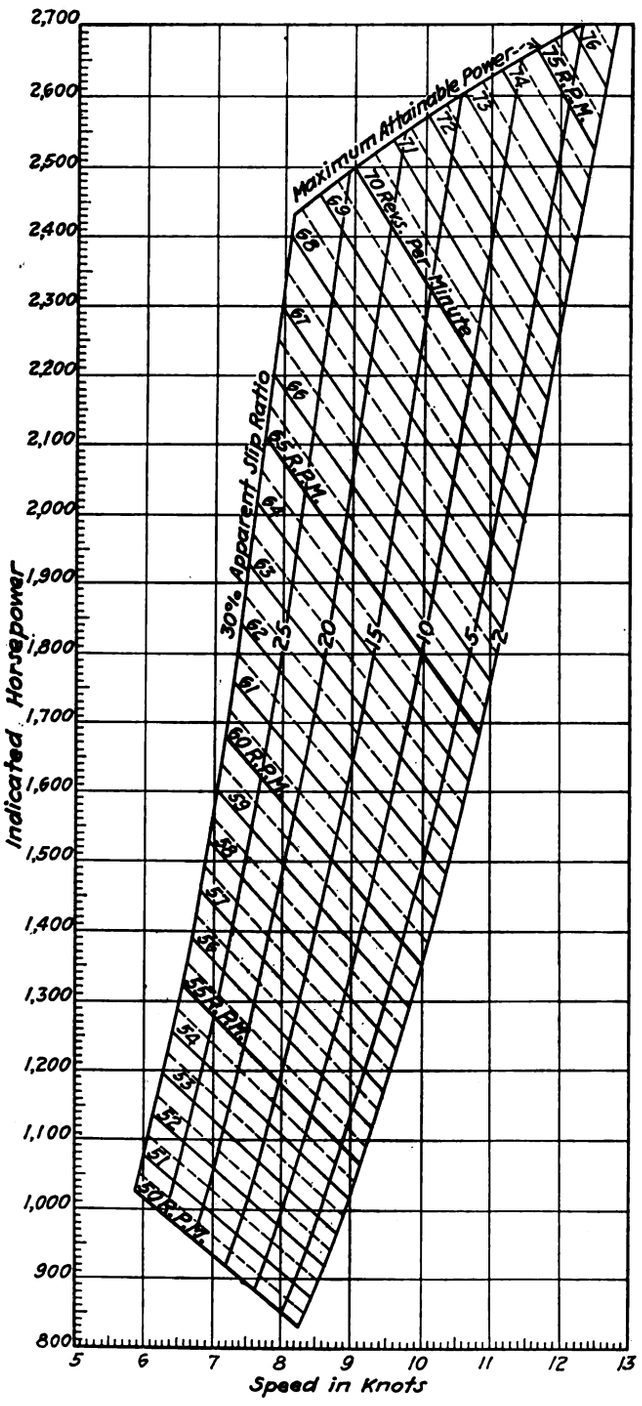

Fig. 4

corresponding real slip, which in conjunction with the mean apparent slip allows the (Taylor) wake fraction w to be determined. We can next take a range of apparent slip values Sa, such as 5, 10, 15, 20, 25 and 30 percent, calculate the values of real slip Sr corresponding to these respective slips from the relation:

$$Sr = (1-w)\ Sa + w$$

and by again referring to the model torque constant curve we can read off the torque constants corresponding to these respective real slips. Finally, these constants should be expressed as ratios of the basis torque constant. If now we return to the basis mean pressure ordinate used for our analysis we can multiply this ordinate by the respective torque absorption ratios above found and lay off the corresponding values as new brake mean pressure ordinates above the constant frictional pressure base. Through the tips of these ordinates we can now draw a series of straight lines all emanating from the constant friction intercept at zero revolutions. This done, the lines can finally be labelled with the apparent slips to which they correspond, the final form of the diagram thus representing the generalized history of the propeller as a torsion dynamometer. (See Fig. 3.)

In effecting the generalization we have had admittedly to leave our basis data and introduce extraneous data represented by the torque absorption properties of the model screw.

This use of model ratios, however, admits of fair latitude in the brake horsepower used to determine torque constant, in the lack of geometric similarity of model and ship screw, and in the resulting physical significance of the wake fraction, without any really practical error being introduced into the final data. The chief advantage of our method is, thus, that it first permits of the immediate checking of power data for consistency, and secondly presents the data in such a form that at any time in the future when greater knowledge of engine and transmission efficiency, ship wake and ship-model correlation becomes available, the data are most conveniently accessible for any desired re-examination without serious over-haul being found necessary.

Having constructed our generalized pressure diagram, we can, if considered necessary, use it to check the probable accuracy of the basis mean pressure line. We can examine every trial observation, and by noting the ratio of the torque constant at the actual slip corresponding to the observation to that of the mean apparent slip, we can modify the actual brake mean pressure in that ratio. Doing this for each of the trial spots, we obtain a series of spots all adjusted to refer to one constant slip. The inspection of the location of the basis mean line to these new spots will rapidly show whether the basis line requires adjustment or not.

To facilitate the application of the methods of the section, the author has converted Schaffran's 37 percent disk-area-ratio, 5 percent blade-thickness-ratio four-bladed model propeller experiment data into nomogram form. This nomogram is shown in Fig. 5. The left-hand scale gives torque constant $\frac{Q}{n^2D^5}$ (in metric units), the center diagonal scale gives pitch ratio, and the right-hand scale real slip ratio. Any straight line across the nomogram at once numerically correlates simultaneous values of the three quantities.

The Generalized Power Diagram: Its Use in Load Trial Speed Power Correlation

The generalized mean pressure diagram, while the most convenient form for the analysis of power data, is expressed in terms of the practically inconvenient quantities, mean referred pressure and apparent slip. The mean pressure diagram can, however, be very simply converted to read directly speed revolutions and power.

The necessary conversion is probably best accomplished in the following form. A diagram should be prepared with ordinates of power and, abscissæ, ship speed. Taking intervals of 5 revolutions in the pressure diagram, the mean referred pressures at constant revolutions for each of the apparent slips should be read off and converted into power,

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the corresponding apparent slips being simultaneously converted into ship speed. These correlated values of speed and power should then be plotted in the power diagram in the form of constant-revolutions lines, thus giving the relation between power and *imposed* speed for constant revolutions. Next, curves should be drawn through the constant slip points on the revolutions lines, thus giving the relation between power and speed for constant slip. Finally, the diagram should be sub-divided to read off the power absorbed at every half revolution over the practical working range of engine and ship speed.

Fig. 4 shows a typical generalized power diagram. One peculiarity of the diagram is worth noting. Consider the 60 revolutions per minute 9 knot point. This corresponds to a power of 1,470. If now we examine the difference in power corresponding to plus or minus half a revolution we

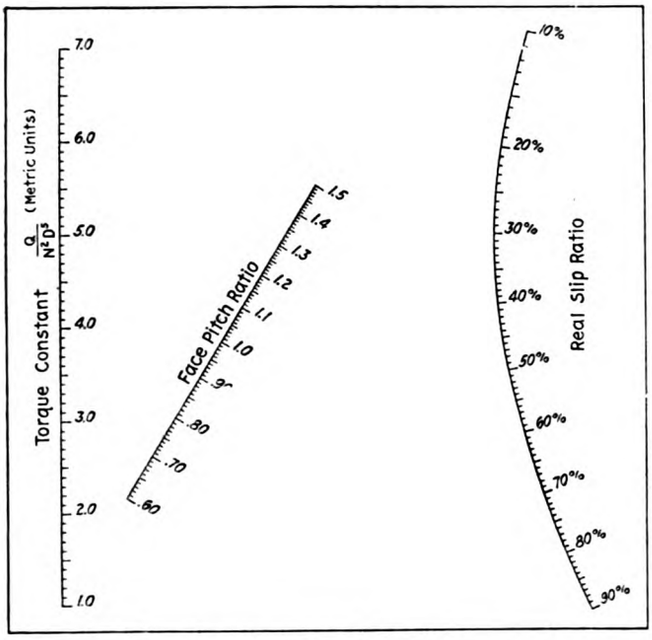


Fig. 5

see that this amounts to 45 indicated horsepower. On the other hand, examining the effect of a quarter-knot error in speed, it is seen that this only amounts to 25 indicated horsepower. This difference in sensitivity is contrary to the views we usually hold on the importance of speed errors. The difference in outlook is solely due to our regarding the propeller as a power dynamometer, revolutions being of primary importance and inflow velocity (as represented by ship speed) being only of secondary importance.

In the light of the generalized power diagram, we can now return to the load-trial data, and consider it from the point of view of correlating speed-revolutions and revolutions-power performance. In the first place the power diagram brings out one important point. Depending upon such external circumstances as weather, fouling, depth of water, and all their possible combinations, a vessel can have on the measured mile an infinite number of speed and power curves. To regard, therefore, the usual measured-mile speed-and-power curve as the unique test of a vessel's capabilities is hardly scientific. Every speed-and-power curve obtained is largely accidental, and a vessel will generally have as many such curves as she has load trials. Contrary to the accidental nature of speed-power correlation, the speed-power-revolutions correlation will be fundamental. In other words, the former is merely a special case of the latter. Thus, having our generalized power diagram, we can at once use it to determine the load-trial speed-and-power correlation. For each run we can read from the diagram the power corresponding to the observed revolutions and corrected ship speed. The speed and power curve constructed from these data will thus be freed from both power and speed inconsistencies, and can be safely regarded as the whole truth of the trial in question.

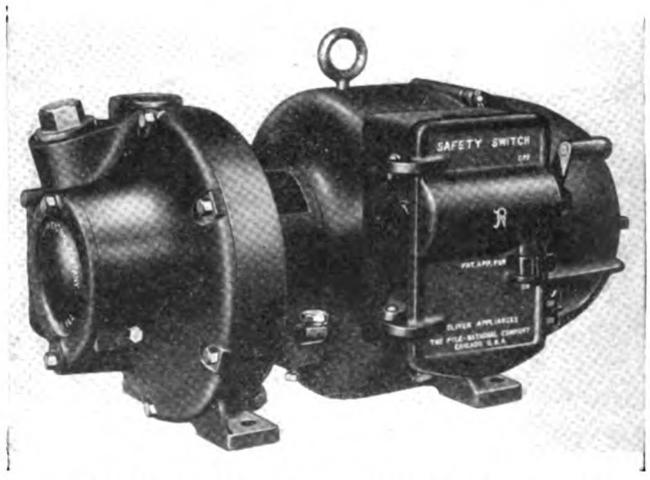
Before concluding this section, one further use of the power diagram may be mentioned. It frequently happens that through various adverse circumstances, such as bad weather, insufficient vacuum, inefficient stoking or coal, the machinery on load trial is unable to develop its full power. As the builder knows that, say with 180 pounds steam pressure, his engine should definitely be capable of exerting a maximum mean referred pressure of 36 pounds per square inch, this maximum can be drawn in the mean pressure diagram and hence its analogue of maximum power at any propeller slip drawn in our generalized power diagram.

(To be continued)

Pyle-National 2½-Kilowatt Portable Turbo-Generator

A NEW 2½-kilowatt, heavy duty, portable turbo-generator, which is completely self-contained, so that it requires no switchboards, fuse panels or rheostats and which has been designed automatically to maintain voltages with extreme accuracy despite wide variations of steam pressure, is a new development of the Pyle-National Company of Chicago. The new unit which is known as type M-2-S is designed to operate on steam and is suitable for use under the most adverse conditions.

The new large capacity permits the unit to handle a continuous load of sixty 40-watt lamps or twenty 500-watt lamps or any combination having a demand of 2½ kilowatts. If it is desired to make use of flood light illumination, the unit will handle a pair of 500-watt flood lights with an additional string of fifteen 100-watt lamps. On



Self-contained 2½-kilowatt portable turbo-generator

all flood light illumination it will handle five large flood lamps continuously with ease.

The design of the turbine and generator follows closely the principles which have been developed by the Pyle-National Company on their turbo-generators during the past 25 years. The unit is designed with heavy duty ball bearings and large capacity oil chambers so that it may be operated continuously over long periods of time without any attention to either adjustment or maintenance. Great rigidity has been provided and careful attention has been given to waterproofing and weatherproofing so that dirt and moisture will not interfere with operation.

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Questions and Answers for Operating Engineers

Practical information for marine engineers on the operation and maintenance of boilers, engines and auxiliaries

This department is maintained to help those who desire practical information regarding engine room problems or who are preparing to take examinations for a marine engineer's license. Readers are urged to send in questions. Inquiries bearing the name and address of the writer will be answered promptly by mail. If the question is of general interest the answer will also be published in an early issue of the magazine, although the identity of the writer will not be disclosed in doing so. Anonymous communications will not be considered.

Why Diesel Cylinder Heads Crack

Q.—What are some of the causes of cracked cylinder heads in a Diesel engine?

A.—Unequal heating due to poor design, air pockets in jacket, insufficient cooling water and overloading.

Faulty Lubrication of Bearings

Q.—What are the effects of too many or incorrectly placed oil grooves in a bearing?

A.—The bearing surface is reduced and the oil escapes from the bearing without spreading over its surface.

Excess Oil in Engine Cylinder

Q.—If one cylinder receives more oil than the others, what effect will it have?

A.—That cylinder will do more than its share of the total work done by the engine and its temperature will be higher.

Protection of Oil Tank Vents

Q.—How are oil tank vents protected against the danger of fire?

A.—By being carried well above deck and ended with an inverted gooseneck, with a wire gauze screen over the open end.

Diesel Engine Pistons

Q.—Why are Diesel engine pistons slightly tapered towards the top?

A.—Because the top is the hottest part of the piston and the greatest expansion occurs there.

Why an Oil Engine May Fail to Start Firing

Q.—What are some of the causes of failure of an oil engine to start firing after it begins to turn on air?

A.—Fuel pumps not discharging oil, incorrect timing of spray valves, low compression, spray air pressure too low and cylinders too cold.

Foaming

Q.—What causes foaming in a boiler?

A.—Foaming is generally caused by the presence of dirt or grease or by carrying the water too high in the boiler or by insufficient steaming space. The latter would make the boiler foam no matter how clean the water might be, due to the fact that the great amount of steam which would be taken out at each stroke of the engine would reduce the pressure to such an extent as to induce violent foaming.

Lap

Q.—What is meant by lap?

A.—Lap is the amount a slide valve overlaps the steam port, when it is in mid position, if it is on the steam side. If it is on the exhaust side, it is the amount it overlaps that side.

Lead

Q.—What is meant by lead?

A.—Lead is the amount the valve is open when the piston is at the end of each stroke. Slightly more lead is generally given at the bottom on account of the weight of the piston being lifted.

Setting an Eccentric

Q.—How would you set an eccentric on a new shaft to have the valve properly set?

A.—Ninety degrees ahead of the crank, plus the amount of lap and lead. Before setting the eccentric, lock it with a set screw and then, by turning the engine around one full turn, make sure the lead is correct for both ends. After it is found to be in the correct position, mark and cut a key way in the shaft.

Engine Room Auxiliaries on a Motorship

Q.—What auxiliary machinery is usually found in the engine room of a motorship?

A.—Jacket cooling water pumps, piston cooling pumps, lubricating oil pumps, fuel oil service pumps, bilge and ballast pumps, fresh water pump, auxiliary air compressor, fire pump, Diesel electric generating sets, donkey boiler, evaporator and distiller, boiler and evaporator feed pumps, emergency compressor, ice machine and oil separator.

Important Observations to Be Made While Operating a Diesel Engine

Q.—Give briefly the more important observations to be made while under way with a Diesel engine.

A.—Watch the air pressures, especially the spray air, and note any change in the relative readings of the gages on the air compressor. See that an ample supply of fuel is kept in the watch tanks. Note the pressures and temperatures in the cooling water and lubricating oil systems. Make regular inspections of the cylinder head valves. Keep the feed of the mechanical lubricators regulated. Keep a sharp lookout for indications of a hot bearing and watch for indications of misfiring or incomplete combustion in one or more cylinders.

Metallic Packing

Q.—What can you say of the tightness and care of metallic packing?

A.—Generally the tightness of metallic packing depends on the fit and cleanliness of the component parts and on

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the condition of the rod. No external adjustment is provided and the only remedy for a leaky condition is to break down, clean and refit or renew worn parts. The basic principle of all metallic packing is a steam tight fit of metallic rings held against a rod by light spring pressure. Too much spring pressure will cause heating and may melt the packing.

Knocking in Steam End of Pump

Q.—To what is knocking in the steam cylinder of a reciprocating pump due?

A.—This is probably due to a piston loose on the rod, loose piston rings, or the auxiliary steam cylinder piston knocking against the heads because of too thin gaskets or a change in relative size of steam ports.

Swelling or Deflection in Tubes of Watertube Boilers

Q.—What is the cause of swelling or deflection in the tubes of watertube boilers?

A.—Swelling and deflection are generally indicative of overheating. The cause is usually internal fouling which has interfered with proper circulation or heat transmission.

Firing Interval for Coal Burning Boilers

Q.—Can you give some rules for determining the firing interval for coal burning boilers?

A.—The following are taken from Engineering Instructions issued by the Navy Department. The data, while perhaps not applicable in detail to your problem, illustrate the methods used in solving such problems.

(1) Assume ship's coal consumption at 15 knots to be 144 tons per day. Boilers are Babcock and Wilcox, having four doors each. Charge is 3 shovelfuls. Boilers in use, 8. Required firing interval.

Let T be the interval between successive firings of a door.

$$\text{Then } T = \frac{10 \times 8 \times 4 \times 3}{144} = 6.7 \text{ minutes.}$$

(2) Assume ship's coal consumption at 12 knots is 108 tons per day. Boilers are Babcock and Wilcox, having four doors each. Charge is 3 shovelfuls. Firing interval desired, 8 minutes. Find number of boilers to be used.

Let N be the number of boilers.

$$\text{Then } N = \frac{T \times C}{10 \times D \times S} = \frac{8 \times 108}{10 \times 4 \times 3} = 8 \text{ boilers.}$$

In which D is the number of doors per furnace and C is the coal consumption in tons per day.

(3) Let ship's coal consumption at full power be 620 tons per day. Number of boilers is 14, Babcock and Wilcox, four doors each. Firing interval is 3 minutes. Find shovelfuls per charge.

Let S be the number of shovelfuls.

$$\text{Then } S = \frac{T \times C}{10 \times D \times N} = \frac{3 \times 620}{10 \times 4 \times 14} = 4 \text{ shovelfuls.}$$

The foregoing rest upon the assumptions below:

(a) Weight of average shovelful of coal — 16 pounds.
(b) Pounds in long ton 2,240.

Then —

$$\text{Pounds of coal per boiler per hour} = \frac{C \times 2{,}240}{24 \times N}$$

$$\text{Pounds of coal per door per hour} = \frac{C \times 2{,}240}{24 \times N \times D} = \frac{16\,S \times 60}{T}$$

$$\text{From which } T = \frac{10\,N\,D\,S}{C}, \text{ approximately.}$$

Safety Valve Rule

Q.—How do you find the weight to be put on a safety valve lever, when the area of the valve, etc., are known?

A.—Roper's rule for finding the weight to be put on a safety valve lever, when the area of valve, etc., are known, is as follows:

Multiply the area of the valve by the pressure in pounds per square inch; multiply this product by the distance of the valve from the fulcrum. Multiply the weight of the lever by one-half its length (or its center of gravity), then multiply the weight of the valve and stem by their distance from the fulcrum. Add these last two products together, and subtract their sum from the first product and divide the remainder by the length of the lever; the quotient will be the weight required.

Note: To get the area of the valve, multiply the diameter of the valve by itself and multiply the product by 0.7854. For instance:

Diameter of valve = 3¼ inches

3.25 × 3.25 ×, 0.7854 = 8.29 square inches, area.

EXAMPLE

Diameter of valve = 3¼ inches.
Area of valve = 8.29 square inches.
Pressure = 110 pounds per square inch.
Fulcrum = 4 inches.
Length of lever = 32 inches.
Weight of lever = 12 pounds.
Weight of valve + stem = 10 pounds.

110	12	10
8.29	16	4
990	72	40
220	12	
880	192	
911.90	40	
4	232	
3647.60		
232		

32)3415.60(106.73 pounds, weight required.
32

215
192

236
224

120
96

24

Viscosity

Q.—Please define the term "viscosity."

A.—This term is used commonly in connection with fuel oil. It is the rate of flow of a certain amount through a specified orifice at a certain temperature.

Proper Lubrication of a Bearing

Q.—Please discuss the action of a properly formed oil film in a bearing.

A.—Satisfactory lubrication in a bearing exists when there is formed an oil film separating the bearing surface from that of the rotating journal. This prevents excessive friction. The friction which is generated is mainly that resulting from the molecules in the oil film sliding across one another. This is known as internal friction and increases with the viscosity of the oil. It results that more heat is generated with the use of heavy than with thin oil. However, when bearing pressures are heavy it is important to use an oil with sufficient body to prevent its being readily squeezed out from between the bearing and journal surfaces.

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Questions and Answers Relating to Naval Architecture and Marine Engineering

Conducted by James L. Bates, Naval Architect, and W. B. Newton, Marine Engineer

This department is maintained for the purpose of answering all questions relating to ships and their machinery. All inquiries should bear the name and address of the writer. Anonymous communications will not be considered. The identity of the writer, however, will not be disclosed unless the editor is given permission to do so.

Function of a Shaft Tunnel

Q.—What are the principal functions of a shaft tunnel? I know it provides access to shaft and bearings. Has it other uses?

A.—One of the principal reasons for fitting a shaft tunnel is to limit the space to which water is admitted in case of damage to the stern tube stuffing box or after peak bulkhead.

The tunnel also serves to protect the shafting and bearings from the cargo stowed in the after holds.

Trunk Hatchway

Q.—What is a trunk hatchway? I have seen the term used but am not clear as to its meaning.

A.—Holms in "Practical Shipbuilding" states that a trunk hatchway is one in which the coaming plates of the different decks are united by a casing or trunk. "They are required in passenger vessels in order that when a hatchway is opened to work the cargo in the hold, the passenger accommodation in the twin decks may be unaffected by the operation."

In some cases trunk hatchways are fitted as part of the watertight subdivision of a ship so that a damage which admits water to a given deck may not necessarily flood the deck or decks immediately above it.

Reserve Buoyancy

Q.—What is meant by the term "reserve buoyancy?" What particular needs does it meet?

A.—Reserve buoyancy is that part of a vessel's maximum possible buoyant force which is not utilized in supporting or floating weight because located above the plane of flotation. Should the vessel be sunk into the water to a greater than its original draft by the addition of a given amount of weight, that portion of the ship's buoyant volume between the original and final planes of flotation is the volume required to furnish buoyancy for the support of the weight added. The original reserve buoyancy has then been decreased by this amount.

In measuring the amount of reserve buoyancy in any case all the volume within the watertight hull and above the designed plane of flotation is included. Deck superstructures such as poop, forecastle or bridge house are included or not depending upon the nature of their construction, whether or not they are properly inclosed to withstand water pressure, etc.

In the foregoing the amount and character of reserve buoyancy have been discussed. The distribution is equally important. In order to prevent seas sweeping the decks to the peril of deck fittings, cargo and even the safety of the ship itself, freeboard or reserve buoyancy sufficient to make the vessel rise to the seas must be provided. Inasmuch as a ship is forced forward against the seas by her machinery, generally independent of weather conditions, freeboard and reserve buoyancy at the bow are of prime importance. This consideration results in pronounced sheer forward or a forecastle. The midship superstructures are fitted to protect access to and ventilation for machinery compartments.

In very high speed vessels the freeboard aft may be very small. For example, note the modern destroyer in which the after freeboard is roughly half that forward. In the average merchant vessels the forward freeboard is but little more than that aft.

Probably the submarine operates with less of reserve buoyancy than any other class of ship. These vessels are designed for complete submergence. Therefore, deck openings are reduced to a minimum and air intakes and access hatches required for constant use are carefully trunked to a considerable height. In extreme cases some of these vessels operate with less than 7 or 8 percent reserve buoyancy.

Thrust at Zero Speed

Q.—How is the thrust developed by a screw under a condition of zero speed to be estimated?

A.—Such an estimate is practicable if the data for the model screw are available. However, the results obtained are subject to considerable error unless the results of dock trials for vessels with similar machinery installations are also obtainable.

Let T = the thrust in pounds.
N = the revolutions per second.
P = the pitch in feet.
D = the diameter in feet.
C_t = the thrust coefficient for the wheel under discussion.

Then—$T = C_t N^2 P^2 D^2$

If dock trial results are not available, the revolutions may be assumed as about ⅔ those for the designed full speed.

A great amount of valuable information relative to screw models of varying characteristics is obtainable from Taylor's "Speed and Power of Ships," plates Nos. 185 to 208.

Model of U. S. Scout Cruiser

Q.—I am interested in ship model making, and would like to have a small sketch of the shape of the stern and the bow of a typical vessel of the U. S. scout cruiser class. I am enclosing a small sketch of a bow and stern I have in mind, and would be glad of your advice.

A.—The U. S. S. *Trenton* is one of the class of ten cruisers completed shortly after the close of the world war.

These vessels are not of the forecastle type shown on your sketch. They have a long upper deck extending from the bow to about the after quarter point. They have a pronounced sweeping sheer. The fine effect of this sheer line is somewhat spoiled by carrying the shell plating up con-

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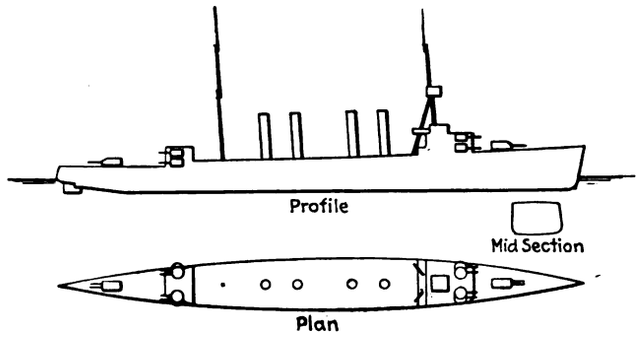
tinuous to form the side of the forward and after gun emplacements.

The sketch reproduced herewith is approximately correct. You will note that the stern contour is similar to that which



Sketch of scout cruiser

you suggest except that the deadwood is not cut up just forward of the rudder quite as far as you suggest.

The actual dimensions, together with their reduced values on a scale of 54 inches = 550 feet, follow:

	For Ship	For Model
Length, waterline	550 feet	54 inches
Beam, extreme	55.3 feet	5.43 inches
Draft	14.25 feet	1.4 inches
Displacement, salt water	7,500 tons	9.2 pounds
Coefficient of water plane area	0.70	0.70
Coefficient of mid section area	0.93	0.93

Testing Condenser System for Air Leaks

Q.—What steps should be taken if air leaks are suspected in a condenser system?

A.—Test with a candle flame while the system is under vacuum. Special attention should be given to pipe lines and joints subject to vibration.

If porous castings, leaky valve stems, etc., are suspected, put the system under air pressure and flood the bilges. Parts above the water may be tested with soap suds.

Relative Steam Consumption of Main Engine and Auxiliaries

Q.—What may be taken as an average relation between the steam consumed by the main engine and auxiliaries?

A.—When in good condition, the auxiliaries usually consume about 10 percent of the total steam at full power, to about 25 percent at one-quarter power, and a still larger percentage at lower powers.

Effect of Unequal Distribution of Power in Triple Expansion Engine

Q.—We have a triple expansion engine that develops 2,300 horsepower. The high pressure cylinder does 750 horsepower, the intermediate cylinder does 850 horsepower and the low pressure cylinder does 700 horsepower. Does the intermediate cylinder by doing more work than either of the other cylinders have a tendency to pull the high pressure and the low pressure cylinders along? If this engine were balanced so that each cylinder was doing the same horsepower would the total horsepower be 2,300 with the same steam pressure and the same revolutions per minute?

A.—It is the opinion of the writer that in no case is the indicated horsepower noted the true horsepower. While the mean effective pressures computed from the cards are correct, the revolutions per minute of the high pressure and low pressure cylinders are raised and the intermediate pressure cylinder pulled down from what might be expected were each cylinder operated independently. It is also believed that no change in total power will result from a more even distribution of work between the three cylinders with the same revolutions per minute.

LETTERS TO THE EDITORS

The Most Important Thing in Welding

ATLANTIC HIGHLANDS, N. J.

TO THE EDITORS:

Referring to the excerpts from the article by Mr. S. W. Miller, page 19, in the January issue of MARINE ENGINEERING AND SHIPPING AGE under the above heading, I am inclined to disagree in several respects. Mr. Miller says: "I disagree with the idea that the operator is the most important link in the chain. I do not think that any one of the items mentioned is of superior importance to the others."

It is true that design is very important. It is just as important as anything else but the modern question is: Which is better—riveting or welding? There is seldom any question about design because the design of most structures is based on science, on mathematics, on experience, and can be checked up on the drawing board. Welding depends upon the skill of one man and cannot be checked so readily.

For the same reason there is little question about materials because materials and their characteristics are very well known. They can be tested before they are used. A rivet can be tested before it is used but a weld cannot be tested before use.

Nor is there any question about methods because methods have been improved gradually since the beginning of time. Welding methods, too, have been improved.

But when it comes to operators, my contention is that a far more skillful and more careful operator is required on welding work than on riveting. It is possible to put an absolutely inexperienced man on riveting jobs and he will turn out work that would be more satisfactory than would be accomplished by an inexperienced welder on a welding job. An inexperienced welder wouldn't get anywhere. An inexperienced boy can insert rivets but an inexperienced boy cannot do welding.

Supervision also is important but I believe it is more important on welding work than on riveting work. The supervisor must be present at all times to see that the welder is doing every inch of welding properly. On riveted work, however, a supervisor can take care of a great many more operations. Therefore, my conclusion is that supervision on welding is of greater importance than on riveting and on riveting work.

Regarding tests, I have just finished reading an interesting article on the testing of welded boiler drums as performed in Germany. They don't merely test up to the boiler pressure, nor to twice the boiler pressure, but they test hydrostatically to a pressure two and three times higher than working pressure. In other words, if the boiler pressure is 600 pounds, the hydrostatic test is carried up to 1,800 or 2,400 pounds per square inch.

This is exceedingly cautious and commendable testing, of course. It creates stresses higher than the elastic limit of the metal and naturally creates internal stresses in the metal. To relieve this strain the drum is heated and annealed after the test.

After such a severe test as this the user can be pretty certain that the boiler is safe under a working pressure of only one-third or one-fourth the test pressure.

This writer's opinion is that autogenously welded boilers or drums will not withstand this severe testing process whereas forge-welded drums and boilers are better adapted to it. Anyway, the A.S.M.E. Boiler Code does not yet permit the use of any kind of welded boiler, whether forge or autogenously welded. It is good practice to always be on the safe side.

M. M. GOOCH.

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Eliminating the Reducing Valve on Steam Machinery

Newark, N. J.

To the Editors:

Two letters have recently appeared in Marine Engineering and Shipping Age under the above heading, the last one being written by D. D. Merrill, president of Engberg's Electric & Mechanical Works.

I fear that some readers may be led to think from the tone of the letters that reducing valves are wasteful and that they should be avoided by the installation of either steam turbines or steam engines through which to reduce the pressure.

While it is true that it is advantageous in certain instances to reduce pressure through steam turbines or steam engines, still I wish to point out that there is nothing wasteful about reducing valves. There is no appreciable heat loss when steam passes through such a valve. The amount of heat on the low pressure side is the same as that on the high pressure side with the slight exception of the heat loss due to the radiation of the valve itself, which of course is exceedingly small—not so great, in fact, as the heat loss from a reducing turbine or engine.

Sometimes it is advantageous to generate high pressure steam as for heating buildings, heating water, etc., and then passing the steam through a reducing valve. If there is any moisture in the steam as generated or before reaching the reducing valve, the moisture almost invariably disappears on leaving the reducing valve. In fact, the steam leaving a reducing valve is generally superheated.

To be sure, where high pressure steam is generated and where power is needed and where the low pressure steam from the engine or turbine can be utilized for heating or process work, it is better to pass steam through an engine or turbine than to pass it through a reducing valve. I am informed that one large American mill is making its own electrical power for $18.10 per kilowatt year of 7,450 hours by passing some of its steam through reducing turbines instead of through an ordinary reducing valve. This cost is equivalent to less than one-fourth of a cent per kilowatt hour, or, $.00243 per kilowatt hour, whichever you prefer.

Steam in this plant is generated at 180 pounds, 50 degrees superheat. The steam is used in process work at 110 pounds per square inch. In reducing the pressure down to this pressure it is passed through the reducing steam turbines. It is estimated that the life of the turbines will be 15 years.

In the same mill are large condensing steam units which do not serve as reducing turbines. They produce power at the cost of $75 per kilowatt year, or just a little over 1 cent per kilowatt hour.

It is estimated that the annual saving due to the reducing turbines is $38,000 per year. Savings of this size are surely worth while.

But at the same time I think it should be made plain that reducing valves are not wasteful and that when correctly used they are an important and economic adjunct to any marine installation or stationary power plant.

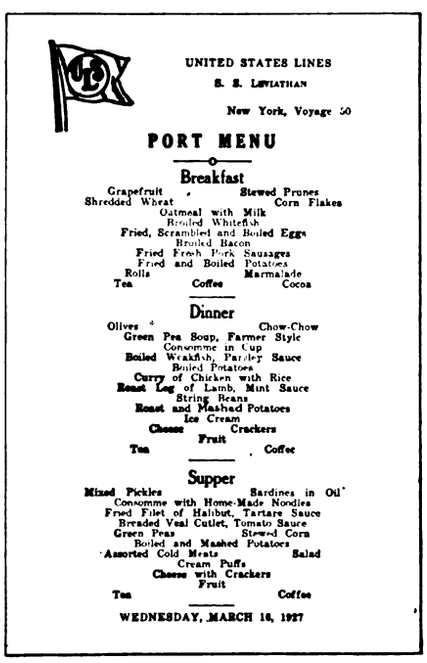
W. F. Schaphorst, M. E.

Lieutenant Commander W. C. Maglathlin, U. S. C. G., will serve as engineer officer of the new Coast Guard Cutter *Northland* now being completed at the yards of the Newport News Shipbuilding & Dry Dock Company, Newport News, Va. The *Northland*, which is 216 feet long and 2,050 tons displacement powered with Diesel electric machinery designed to give her a speed of 11 knots, will sail for San Francisco this month, according to present plans, to replace the *Bear* in Arctic service.

The Engine Room Personnel of the Leviathan on Her 50th Voyage

By G. W. Stutt

THE engine room personnel of the *Leviathan* is 100 percent Americanized and a finer body of men could not be assembled anywhere in the world. Every man has his station, knows his job, and all work together in harmony for the welfare of the ship. Mr. Fagan, the chief engineer, deserves great credit for building up such a wonderful personnel.



UNITED STATES LINES

S. S. LEVIATHAN

New York, Voyage 50

PORT MENU

Breakfast

Grapefruit — Stewed Prunes
Shredded Wheat — Corn Flakes
Oatmeal with Milk
Broiled Whitefish
Fried, Scrambled and Boiled Eggs
Broiled Bacon
Fried Fresh Pork Sausages
Fried and Boiled Potatoes
Rolls — Marmalade
Tea — Coffee — Cocoa

Dinner

Olives — Chow-Chow
Green Pea Soup, Farmer Style
Consomme in Cup
Boiled Weakfish, Parsley Sauce
Boiled Potatoes
Curry of Chicken with Rice
Roast Leg of Lamb, Mint Sauce
String Beans
Roast and Mashed Potatoes
Ice Cream
Cheese — Crackers
Fruit
Tea — Coffee

Supper

Mixed Pickles — Sardines in Oil
Consomme with Home-Made Noodles
Fried Filet of Halibut, Tartare Sauce
Breaded Veal Cutlet, Tomato Sauce
Green Peas — Stewed Corn
Boiled and Mashed Potatoes
Assorted Cold Meats — Salad
Cream Puffs
Cheese with Crackers
Fruit
Tea — Coffee

WEDNESDAY, MARCH 16, 1927

The meals served to the engine room staff could not be better as the sample menú will show. Good table linen, glassware and china, plenty of mess men, wonderful cooking and a loud speaker add materially to the attractiveness of the mess service and, as there is always good feeling among the men, the atmosphere in the engineer officers' mess-room at meal time is no different from that in the dining room of a first class hotel or a social hall aboardship.

The living quarters are good. Electric fans in every room add to the comfort in these quarters. Plenty of bath and face towels are always provided and showers and wash rooms are conveniently situated.

Besides the list of names below, the *Leviathan* carries 30 oilers, 24 water tenders, 48 firemen, 20 wipers, 6 machinists and 3 boiler makers, making a total of 211 for the engine room staff all told.

Here's wishing the entire engine room staff a successful and pleasant voyage on her 50th round trip.

Engine Room Personnel of *S. S. Leviathan*

Chief engineer, J. J. Fagan.

Staff chief, J. W. Condon.

First assistant engineers, C. H. Isgar, M. P. Iverson, E. I. Dawson.

Second assistant engineers, G. Begley, L. F. Schlick, A. M. Davis, C. C. Clark, J. W. Thomas, K. M. Swimm.

Senior third assistant engineers, P. J. Delahanty, A. M. Schlexer, L. Hickey, N. Valencia, L. Nicholson, J. Kinsella, W. Fallon, J. A. Smith, D. Coogan, C. Woodall, J. Coyne, G. Clow, G. Zercher, L. Verber, C. Merry.

Junior third assistant engineers, R. Reber, F. MacNeill, J. Olbers, J. J. Fay, R. Wilkins, A. Herlihy, H. Ali, J. E. Thomas, I. H. Jones, E. Rawlings, J. Toohey, J. Dondero, W. Kaiser, W. Smith, W. Young.

Fourth assistant engineers, E. Brailas, J. P. Martin, W. Palm.

Junior engineers, C. Hudgins, W. J. Walker, J. Shaknitz.

Fan engineers, J. Nicholas, S. Perry, I. Anderson.

Hydraulic engineers, C. McGiven, R. Gillis, F. Hart.

Deck engineers, P. Olts, E. Askew, W. Baranaskas.

Refrigerating engineers, T. Mailander, chief; R. Wilkinson, 2nd; W. Slement, 3rd; M. Swenson, 4th.

Electricians, H. Fochs, chief; F. Neely, 2nd; T. E. Brown, 3rd; J. Fleming, 4th; H. Macy, 5th; W. Dunn, 6th; G. Hough, 7th.

Assistant electricians, J. A. Carey, R. Dillera, J. Enright, J. Gallagher.

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Plumbers, A. W. Thomas, chief; R. Wood, 2nd; W. Ashby, 3rd.
Assistant plumbers, R. Atwell, J. Waldron, H. Vanblarcom.
Chief machinist, P. C. Miller.
Chief yeoman, E. L. Reiss; R. Yanez, 2nd.

PERSONAL MENTION

A. ZIMMERMANN recently appointed first assistant engineer of the steamship *Stanley Dollar,* replaces J. M. Butler who held this post before.

HAROLD HONORE has joined the engine room staff of the *Maunalei* as second assistant. This vessel is one of the Matson Navigation Company's fleet.

P. J. QUINLAN, formerly first assistant engineer of the S. S. *Kroonland,* is now chief engineer of the steamship *Montana* of the Atlantic Transport Line.

C. L. CHENEY has been promoted from second assistant engineer to first assistant on the *L. C. Hanna,* of the Great Lakes fleet managed by the M. A. Hanna Company, of Cleveland.

F. R. ALTMAN has been appointed first assistant engineer on the steamship *Lurline* operated by the Matson Navigation Company. The chief engineer of this vessel is J. T. Anderson.

LEE C. HENSLEA, treasurer of the Cleveland Lodge No. 4 of the International Shipmasters' Association, who recently underwent an operation in a Cleveland hospital, is away on a vacation.

WALDO C. PEARSON has been made third assistant of the Grace liner *Coya.* Some time ago Mr. Pearson served under his present chief, William D. Gonzales, on the steamship *Cacique.*

ARTHUR SIMONSON was elected vice president of the Falk Corporation, Milwaukee, Wis., at the recent annual meeting of the board of directors. Mr. Simonson was born in Sheffield, England and educated at the public schools and the Sheffield Technical School at that place. He served his apprenticeship in the steel foundry department of Edgar Allen & Company, Ltd., Sheffield. In 1900 he came to the United States as representative of Alexander Tropenas, inventor of the side blow converter, and installed this process in various plants. For some years he was general foundry superintendent of William Wharton, Jr., & Company, Inc., Philadelphia, Pa. Since 1910 Mr. Simonson has been retained in various capacities in the steel foundry of the Falk Corporation, finally holding the position of manager of this department since 1916.

Arthur Simonson

A. E. SMITH, formerly chief engineer on the steamship *Lake Markham,* owned by the Central Dredging Company of Chicago, Ill., has accepted a position with the Vacuum Oil Company with headquarters at Chicago, replacing John H. Lynch, deceased.

FRED W. CALL, W. W. LINGO and WALTER GOWAN have been appointed first, second and third assistants respectively to Anton Gardner, chief engineer of the Swayne & Hoyt freighter *Pawler.*

MURLIN E. LEE, formerly third assistant on the Grace liner *Condor,* has been promoted to the position of second assistant replacing O. A. Woodworth who is to be transferred to another vessel.

IRA SHORT, formerly gear engineer of the engineering department at the South Philadelphia Works of the Westinghouse Electric & Manufacturing Company, has been promoted to the position of marine engineer. Mr. Short was born in Woodville, Michigan, in 1890. He was graduated from the North Carolina State College with the degree of B.S. in mechanical engineering, and in 1911 entered the apprenticeship course of the Westinghouse Electric & Manufacturing Company at East Pittsburgh. In 1912 Mr. Short was transferred to the condenser engineering department, specializing on condensing apparatus as applied to marine installations. He remained in this work until 1917 when he was transferred to the marine engineering department. Mr. Short continued in marine engineering work until 1923 at which time he was promoted to the position of gear engineer, continuing in this capacity until his recent appointment as marine engineer. During his work with the Westinghouse Company, Mr. Short assisted in designing propulsion equipment for a number of United States Navy destroyers and merchant vessels.

Ira Short

H. CLAUSON is chief engineer of the *Argossy* operated by Moore & McCormack of New York. In our March issue it was crroneously stated that Mr. Clauson was first assistant engineer of this vessel.

STANLEY WIRES, of Middle Bass Island, chief engineer of the Lake Erie steamer *Chippewa,* has been reemployed for 1927 by the directors of the Sandusky & Islands Steamboat Company, Sandusky, O.

JOHN BOUDIE has been appointed first assistant on the steamship *Point Loma* by Peter Rodland, chief engineer. The *Point Loma* is operated by the Hartwood Lumber Company, Inc., San Francisco, Cal.

P. G. MCCORD, fleet manager for the Shipping Board laid-up fleet at New Orleans, has been promoted to district manager for the Gulf, as of March 1. He succeeds Captain E. T. Flynn, who has been transferred to Norfolk, Va.

WILLIAM H. BARKER and ELMER HUNTER have been made first and second assistants respectively on the steamship *Edna Christensen* operated by Sudden & Christensen, Inc., San Francisco, under Aloysius P. Costello, chief engineer.

A. BENNETT has been appointed as one of the second assistants on the liner *President Cleveland* to succeed Winslow Nott who has resigned. Other new appointments on the *President Cleveland* are three licensed juniors, W. F. Maguire, William Hood and Arnt Anderson.

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E. W. Allaf has been promoted to the position of first assistant on the steamship *Sidney M. Hauptman* of the Charles R. McCormick Lumber Company, San Francisco. G. P. Reddottee has replaced Mr. Allaf as second assistant.

R. A. Macpherson has been made first assistant of the steamship *Condor* by Carl M. Thorsen, chief engineer. C. V. Quinn was at the same time appointed third assistant of this vessel which is owned by the Grace Line, Inc., New York.

James E. Knox has been promoted to the position of first assistant to John A. Carlson, chief engineer of the Matson Navigation Company freighter *Mahukona*. J. C. Ewald was also promoted to second assistant on the same vessel.

Charles Nash has been appointed chief engineer, Curtis C. Kimball first assistant, G. A. Nybert second assistant and Lloyd A. Brandon third assistant on the Charles Nelson Company, Inc., San Francisco, steamship *Buffalo Bridge*.

John Lubeck who joined the *Newport* some time ago as second assistant and was subsequently made first assistant has now been promoted to the position of chief engineer of this vessel which is operated by S. S. Newport, Inc., San Francisco, Calif.

Otto Pushman, who was recently transferred from the post of chief engineer on the Shipping Board vessel *Montague* to that of chief on the steamship *West Prospect*, has been replaced on the *Montague* by Lloyd R. Wahlgren. William H. Walton is first assistant to Mr. Wahlgren.

James Swan, editor of Marine Engineering and Shipping Age, sailed from New York on the *Leviathan* on March 19 for a two months' trip to England, Scotland, France, Holland and Germany. While in London, Mr. Swan will attend the annual meeting of the Institution of Naval Architects.

William J. Sykes has succeeded Merrill C. Johnson as chief engineer of the Panama Mail liner *Colombia*. William W. Bowers has been promoted to the position of first assistant and Harvey C. Garrett, Hugh Toomey and William J. Connolly have been appointed second, third and licensed junior engineers.

D. F. MacDonald has been appointed New England agent of the Great Lakes Transit Corporation, with offices at 515 Boston Chamber of Commerce Building, Federal street, Boston, Mass. He succeeds P. T. Stuart, who recently resigned to become New England traffic manager of the American Republics Line under the management of C. H. Sprague and Son, Inc.

Walter Pringle, former Great Lakes captain but who has been making oil paintings of lake vessels which attracted much attention in marine circles in Cleveland, has won second prize in an exhibit at Sebring, Fla. The winning painting was one of the tug *Guardian* and was entered by Captain R. C. Pringle, father of the painter, now living at Sebring. Some of Captain Pringle's paintings are now on exhibit in a show window at the offices of the Upson-Walton Company, 728 Superior avenue, Cleveland.

Carl E. Petersen has resigned as manager of the technical department of the New Jersey Asbestos Company, New York, to become senior assistant to Rear Admiral Robert Stocker, in charge of the reconstruction of the liner *America* at the Newport News Shipbuilding and Drydock Company, Newport News, Virginia. Mr. Petersen was formerly naval architect for the United States Lines and last spring had charge of preparing plans and specifications for the reconditioning of both the steamship *America* and the steamship *Mount Vernon*.

Joseph E. Sheedy, European director of the Merchant Fleet Corporation, has resigned, effective May 31. His successor has not yet been appointed.

J. Harry Philbin, vice president of the Merchant Fleet Corporation, will sail early this month for a European survey in the interests of the Shipping Board.

Two first assistant engineers have been promoted to chief engineers in the Great Lakes fleet of the Pioneer Steamship Company, managed by Hutchinson and Company, Cleveland, O. One new vessel, the *L. E. Block*, has been added to the Inland Steamship Company, also managed by the Hutchinson concern. While one vessel has been added to the fleets of the Hutchinson concern the number of ships to be operated during 1927 will be the same as last season.

Engineers for the Inland Steamship Company vessels are: F. N. Lang for the *L. E. Block;* W. B. Rowe for the *Joseph Block;* W. L. Smith for the *N. F. Leopold*.

Engineers for the Pioneer Steamship Company are: S. H. Shotwell for the *P. D. Block;* G. Blauvelt for the *C. L. Hutchinson;* H. T. Landers for the *J. J. Sullivan;* A. A. Wolf for the *J. G. Butler, Jr.;* A. L. Holl for the *A. A. Augustus;* G. Schroeder for the *G. A. Tomlinson;* H. McLaughlin for the *John Stanton;* J. A. Rigby for the *W. H. McGean;* P. T. Biddle for the *W. A. Paine;* E. L. Espeland for the *J. P. Walsh;* C. H. Shunlson for the *J. S. Manuel;* A. Kronberg for the *J. E. Ferris;* John Linden for the *F. Billings;* Roy Drew for the *P. McKinney;* P. B. Johnson for the *M. Mullin;* Lloyd Backie for the W. D. *Calverley, Jr.;* E. J. Fournier for the *Amazon;* E. P. Moens for the *S. B. Coolidge;* E. W. Wolfe for the *D. P. Thompson*.

There will be no change in the line up of the fleet of the Kinney Steamship Company, Cleveland, O., this season. Five ships will be operated, their names and chief engineers being; *R. L. Ireland,* engineer, T. Brownlee; *J. S. Ashley,* engineer, John Norton; *A. T. Kinney,* engineer, E. A. Gustin; *A. S. Upson,* engineer, Clark Swartz; *R. B. Wallace,* engineer, A. Walter D'Clute.

The Paterson Steamship Company, Ltd., Fort William, Ont., will add five vessels to its fleet this season. The new boats are being built at Newcastle, Eng., and will come out during April. Two boats of the fleet, the *Newbrundoc* and *Norvadoc,* are now in English waters. The line up of vessels and engineers on the lakes this season for this company is as follows: *Regulus,* W. T. Smith, chief engineer; *Hydrus,* T. Dryburgh, chief engineer; *Argus,* C. B. Scott, chief engineer; *Moses Taylor,* Edward Hurl, chief engineer; *Ontadoc,* R. Duguid, chief engineer; *Saskadoc,* F. Collier, chief engineer; *Mantadoc,* W. T. Rennil, chief engineer; *Prindoc,* John Barrett, chief engineer; *Altadoc,* John Nicoll, chief engineer, *J. A. McKee,* Frank Hicks, chief engineer; *T. J. Drummond,* J. H. McMillan, chief engineer; *Fordonian,* H. Pickard, chief engineer; *Bricoldoc,* C. Gray, chief engineer; *Canadoc,* L. Butler, chief engineer; *Quedoc,* D. Munro, chief engineer.

A steamer and barge have been bought and added to the fleet operated by Frank J. Peterson on the lakes. The barge *Alexander Holley* and steamer *John Ericsson* were bought by him of the Pittsburg Steamship Company. The Peterson interests operate two lines—the Peterson Steamship Company and the Midwest Transportation Company. Vessels of the former are—*F. J. Person Peterson,* engineer, G. V. Vosburn; *John Ericsson,* engineer, George Winter; *Alexander Holley,* engineer, A. C. Thompson.

Midwest Company—*O. J. Lingeman,* engineer, A. Cascadden; *Aetna,* engineer, A. Olmstead.

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The Month's Shipping and Shipbuilding News in Brief

Shipyard, Steamship and Port Activities and Other Notes of Interest in All Branches of the Marine Industries

Hull of Liner Mount Vernon in Good Condition—Specifications to Be Out Soon

SO far the results of the hull inspection by the American Bureau of Shipping of the Shipping Board liner *Mount Vernon,* which was drydocked March 17, have been entirely satisfactory and indications at present are that specifications will be issued within a short time covering complete reconditioning work.

It is understood that Gibbs Brothers, Inc., naval architects, New York, are preparing a proposal for the reconditioning of this vessel which will receive consideration when completed. In the meantime the Shipping Board is laying plans to issue specifications that the Department of Construction and Repair has now under preparation.

It has been ascertained that the Shipping Board specifications will closely follow those submitted to builders and repair yards in May, 1926, which included the following work: Repairs, renewals, reconditioning and alterations to convert the vessel for cabin, tourist and third class passenger and cargo service; drydocking and underwater work; reconditioning and outfitting of cabin, public rooms and original suites, together with certain fixed furniture; the furnishing and installation of "A-B" berth combination and "C" sofa berths and "C-D" sofa berth combinations in certain staterooms; portable furniture for cabin and tourist class, public rooms and lobbies and carpets.

The principal dimensions, etc., are: Length overall 706 feet 6 inches; length between perpendiculars, 680 feet 4 inches; beam, molded, 72 feet; depth molded to "B" deck at side, 52 feet 6 inches; frame spacing (general) 30 inches; normal mean load draft, 31 feet 6 inches, and displacement 28,444 tons.

The main boilers: 7 single ended and 12 double ended Scotch, natural draft. As reconditioned it is intended to use six single ended and six double ended boilers known as Nos. 2 and 3 groups, located centrally between Frs. 125-184, and it is also intended to have the three double ended boilers, known as No. 4 group, fitted up for reserve.

There will be 4 quadruple expansion main engines, with cylinders 37.4, 49.2, 74.8 and 112.2 inches diameter by 70.9 inches stroke.

It was originally planned by the Shipping Board to utilize the two after engines only for propulsion when the vessel was reconditioned. The main propelling machinery originally developed about 44,000 indicated horsepower, giving the vessel a speed of 23.5 knots. In the reconditioned state, with the two after engines in use, the main propelling machinery would develop about 22,000 indicated horsepower, giving the vessel a sea speed of approximately 18 to 20 knots. It is not known as yet whether any changes in machinery plans will be made this time.

The original plans for reconditioning the *Mount Vernon* were issued in June, 1926, with the result that the Tietjen and Lang plant of the Todd Shipyards Corporation, New York, submitted the lowest proposal at a price of $2,790,170 and a time of 295 days. It is believed that the bids when taken on the revised specifications will run at least to this amount and the expectation is that it will run higher with the additional work that will be required.

Coolidge Signs Loan Construction Fund Amendment

AMONG the bills approved by President Coolidge on the last day of the Sixty-Ninth Congress, March 4, was Senate Bill No. 3896, authorizing the Shipping Board to continue crediting to the "construction loan fund" proceeds of ship sales until the full amount of $125,000,000 contemplated by the merchant marine act of 1920 has been attained. The bill was passed by the Senate on February 7 and by the House on March 2.

Chesapeake Line Will Build Steamer to Replace City of Annapolis

INFORMATION has been received that the Chesapeake Line will within the near future prepare plans and specifications for the construction of a new steamer to replace the *City of Annapolis,* which was recently rammed and sunk by her sister ship the *City of Richmond.* The latter vessel, which had a hole of about 20 feet torn in her hull, is now being repaired. The collision occurred in a heavy fog on the Chesapeake Bay, off Smith's Point and near the mouth of the Potomac River.

The new steamer to replace the *City of Annapolis* will have the same general characteristics as this vessel. The date on which specifications will be issued has not as yet been determined, but it will probably be within a comparatively short time. The *City of Annapolis* was a steel vessel, having a length of 261.6 feet, beam of 53.1 feet and a depth of 14.1 feet, with a carrying capacity of 1,923 tons deadweight. She was built at the Sparrows Point plant of the Bethlehem Shipbuilding Corporation, Ltd., in 1913. The *City of Annapolis* was equipped with a four-cylinder triple expansion reciprocating engine, having cylinder diameters of 23 inches, 38 inches, 45 inches, and 45 inches with a stroke of 36 inches, developing 2,300 indicated horsepower. Steam was supplied by four Scotch boilers, at a working pressure of 190 pounds per square inch.

Conversion Contracts for Three Shipping Board Vessels Soon to Be Placed

INFORMATION has been received that the Maintenance and Repair Division of the United States Shipping Board, Captain R. D. Gatewood, manager, 45 Broadway, New York City, will take action within the next few days on the award of the Diesel engine installation work on the Shipping Board freighters *West Gramma, Seminole* and *Yomachichi.* The bids for these conversions were received February 15.

The Bethlehem Shipbuilding Corporation, Ltd., Bethlehem, Pa., submitted a low bid for the *West Gramma,* with a price of $575,000. The Tietjen and Lang plant of the Todd Shipyards Corporation, Hoboken, New Jersey, offered to fit the *Seminole* at a price of $579,590, while the Newport News Shipbuilding and Drydock Company, Newport News, Va., would do the *Yomachichi* for $527,500. It is understood that these figures have since the receipt of bids been reduced somewhat and the work will probably go to these yards.

Navy Department Increases Number of Cruisers to Six for Construction Proposals

TENDERS for the construction of six scout cruisers, *Numbers 26* to *31,* inclusive, will be received by the Navy Department, Washington, D. C., until April 5, 1927. These cruisers are restricted to 10,000 tons displacement by the terms of the treaty for the limitation of armament and bids of three classes may be submitted under proposals issued.

Bids will be received for the construction of one or two cruisers, complete, hull, main turbines, gears, boilers and auxiliaries; for construction of one or two with hull, boilers and auxiliaries, with agreement that main turbines will be furnished by the government, or for from one to six sets of propelling machinery in accordance with specifications.

The proposals represent a modification of bids requested by the department December 21, for construction of hull and machinery of three cruisers, *Numbers 26* to *28,* which were to have been opened on March 10, funds for beginning of these three having been appropriated in the naval bill of 1926-7.

When President Coolidge signed the naval bill for the fiscal year 1927-28, $450,000 was immediately available for start of construction of cruisers *Numbers 29* to *31,* and the department consequently extended time for submitting proposals on the first three.

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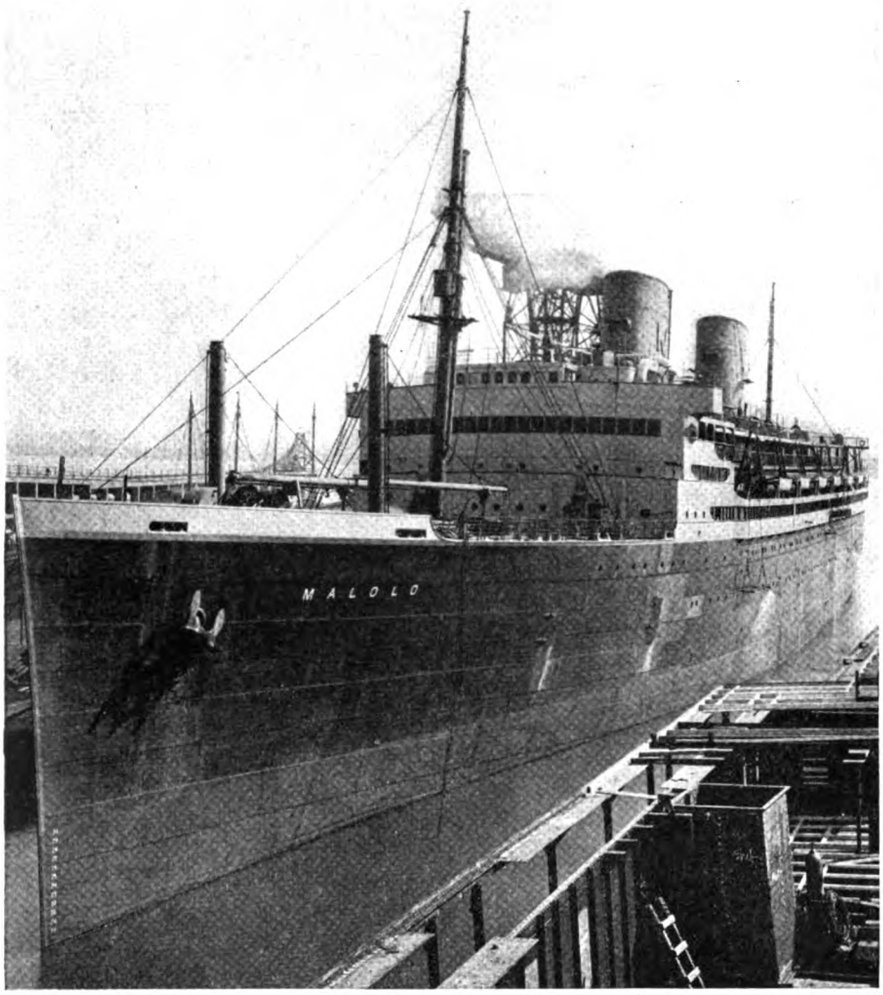

Matson liner Malolo at the fitting out dock at Cramps' shipyard, Philadelphia. Fifteen hundred men are at work on the vessel each day

Specifications for Three Fireboats for City of Portland to Be Issued Shortly

OFFICIAL information has been received that plans and specifications for the construction of three new fireboats for the city of Portland, Oregon, which were previously scheduled to be issued on March 15, have been postponed by C. A. Bigelow, Commissioner of Public Affairs, for approximately 10 days, at which time advertisement for bids will be authorized. The boats are to be either Diesel or gasoline driven and will cost close to $750,000 for the three boats.

River Boat for Alaska Game Commission

THE Alaska Game Commission recently awarded the contract for a 43-foot tunnel stern river boat to Schertzer Brothers, who have a plant on Lake Union, Washington. The vessel will cost approximately $5,200 and will be built of wood in accordance with plans and specifications prepared by Coolidge and Hanson, Seattle naval architects.

The new vessel is to be used as a patrol boat in the protection of game along Alaska rivers. She will be equipped with a 50-horsepower engine and will be able to maintain a speed of 11 miles an hour in service.

Newport News Yard to Build Ellis Channel System Barge

A CONTRACT for the construction of a 300-ton derrick barge has been awarded to the Newport News Shipbuilding and Drydock Company, Newport News, Virginia, by the Merritt, Chapman and Scott Corporation, New York, to be built on the Ellis Channel system. The price involved was not given out.

Standard Oil Co. of California May Build Tankers Abroad

THREE new 15,000-ton tankers are to be built by the Standard Oil Company of California in foreign yards. The action of the Standard Oil Company of California in awarding shipbuilding contracts abroad is in line with the policy that has been followed by the Standard Oil Company of New Jersey, which company has within the past two years built 18 Diesel driven tankers in foreign yards, principally in Germany.

Former Hospital Ship Comfort May Be Conditioned for Service by Mallory Line

CAPTAIN WILLIAM CLARK, general superintendent of the Clyde-Mallory Line, New York, accompanied by Theodore E. Ferris, naval architect, 30 Church street, New York, recently arrived at San Francisco, California, to inspect the former naval hospital ship *Comfort*, which has been tied up at San Francisco for the last two years, with a view to reconditioning it for the Mallory Line service between New York and Galveston.

The vessel was purchased April 1, 1925, from the Navy Department by the General Metals Supply Company of San Francisco, for the sum of $151,000, and at the time of the sale by the Navy Department it was understood the steamer was to go into the service of the Pacific Steamship Company in the coastwise trade on this Coast. The Pacific Steamship Company for a time considered putting the steamer into the trade with the *Dorothy Alexander*, but the cost of reconditioning the vessel was considered prohibitive.

The machinery in the *Comfort* is reported to be in good condition, but to make the liner ready for passenger service, it has been estimated would cost not less than $500,000. It is generally understood that the *Comfort* soon will be plying in the Mallory service on the East Coast.

Ward Engineering Works to Build Diesel Towboat for Army Engineers

THE Charles Ward Engineering Works, South Side, Charleston, West Virginia, has been awarded the contract for the construction of a 110-foot Diesel, steel hull towboat, by the United States Engineer Office, St. Louis, Missouri, at a price of $126,800, bids for which were received at St. Louis on January 29. The vessel is to have a length overall of 131 feet 5/8-inch; length, molded, 110 feet; breadth, molded, 23 feet; depth, 5 feet; camber, 4 inches; mean draft loaded, with full supply of fuel, water, supplies and equipment, 3 feet 6 inches; sheer, forward, 2 feet 6 inches; sheer, aft at sides, 1 foot 6 inches.

The boat is to be equipped with one 300-brake horsepower vertical, multicylinder, two or four stroke cycle, air injection Diesel type engine, arranged for electric drive.

International Petroleum Co. Asks Bids on Sternwheel Towboat

THE International Petroleum Company, Ltd., Toronto, Ont., Canada, is asking bids for the construction of a sternwheel towboat, specifications for which were recently issued to various yards in this country. No date has as yet been set on which bids will be opened.

The towboat will be of the typical Mississippi River sternwheel type, having a length of about 200 feet and will be equipped with reciprocating propelling machinery. According to the specifications, the boat is to be delivered with the wheel unshipped and stored on the deck and in a sea worthy condition for towing to South America, where she will be placed in the river service by the International Petroleum Company.

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Ship Construction and Repair Bids

Repair Contract on S.S. Black Sea Awarded New York Harbor D. D. Co.

A CONTRACT for repairing the British tanker *Black Sea,* a motorship of 2,961 gross tons, owned by the British-Black Sea Shipping and Oil Company, Ltd., of London, which was badly damaged on Wednesday, February 23, by fire resulting from an explosion while lying at Pier 5, Bayonne, N. J., has been awarded to the New York Harbor Drydock Company, Inc., New York City, at a price of $55,638 and a time of 40 days. The tenders for the work were received and opened at the office of Charles E. Ross, naval architect, 16 Exchange place, New York, on Tuesday, March 22. Other bids received for the work were:

Name	Price	Days
W. and A. Fletcher Company.....	$61,000	46
Tietjen and Lang Drydock Company	67,417	52
James Shewan and Sons, Inc.....	69,000	50
Robins Drydock and Repair Company	69,840	53
Morse Drydock and Repair Company	77,357	37
Staten Island Shipbuilding Company	81,460	60
Newport News Shipbuilding and Drydock Company	87,000	68

Standard Oil S.S. William G. Warden Goes to New York Harbor Yard for Repairs

A CONTRACT for repairs to the steamship *William G. Warden* of the Standard Oil Company of New Jersey, 26 Broadway, New York, was recently awarded to the New York Harbor Drydock Company, Inc., 17 Battery Place, New York, at a price of $13,788, bids for which were received at New York, on Tuesday, March 15. Other tenders received were:

Robins Drydock and Repair Company...	$14,671
Morse Drydock and Repair Company..	19,947

Repair Bids for Steam Lighter Transport

PROPOSALS were received and opened in New York on Wednesday, March 23, for repairs to the steam lighter *Transport* of the Clyde Lighterage Company, Inc., 24 Stone street, New York City. The bids submitted are as follows:

Name	Price	Days
Theodore Crane's Sons Company..	$19,752	50
Morse Drydock and Repair Company	20,546	55
James Tregarthen and Sons Company, Inc.	20,889	60
Tietjen and Lang Drydock Company	20,967	52
Ira S. Bushey and Sons, Inc.....	21,000	55
Staten Island Shipbuilding Company	21,000	50
Union Shipbuilding Company.....	21,650	61

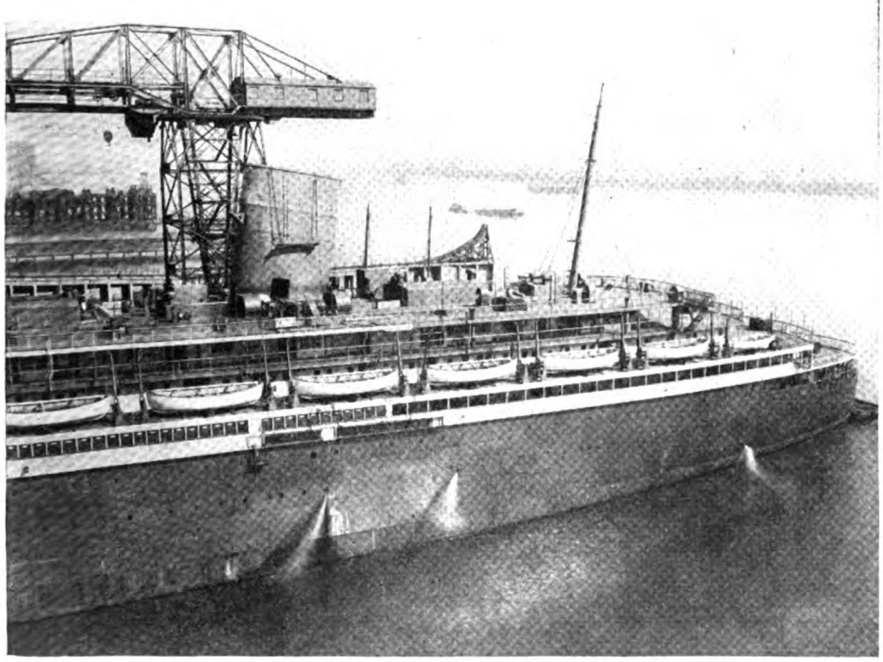
The award has not as yet been made.

Nashville Bridge Co. Low Bidder for Two Barges

WITH a price of $16,050, the Nashville Bridge Company of Nashville, Tennessee, submitted the lowest proposal for the construction of two 100 feet by 24 feet by 5 feet steel barges, bids for which were received and opened by the United States Engineer Office, St. Louis, Mo., on Friday, March 18. Other tenders received for the work were:

Midland Barge Company.....	$18,000
American Bridge Company.....	25,000
Midwest Boat and Barge Company.....	26,000

The award has not as yet been made.



Birdseye view of the stern of the Malolo, showing details of the superstructure

Morse Drydock Company Receives Repair Contract for S.S. Agwiworld

BIDS were recently received by V. K. Hull, manager of the International Shipping Corporation, 25 Broadway, New York City, covering heavy weather repairs to the steamship *Agwiworld.* Specifications were divided into three parts dealing with deck damage, plate damage, tank repairs and engine and shaft repairs. The following bids were received:

Name	Price	Days
Morse Drydock and Repair Company	$38,995	19
James Shewan and Sons, Inc..	39,144	30
New York Harbor Drydock Company, Inc.	39,722	20
Staten Island Shipbuilding Company	41,800	21
Federal Shipbuilding Company.	43,500	22
Robins Drydock and Repair Company	49,500	18

The work was awarded to the Morse Drydock and Repair Company, Brooklyn, New York, who submitted the lowest figure.

S.S. Katahdin Repairs Awarded to Fletcher Yard

BIDS were opened Thursday, March 10, at the office of the marine superintendent of the Clyde Steamship Company, New York City, covering heavy weather repairs to the steamship *Katahdin.* The bids received for the work are as follows:

Name	Price	Days
W. and A. Fletcher Company...	10,300	12
Tietjen and Lang Drydock Company	11,342	9
Robins Drydock and Repair Company	11,730	12
Morse Drydock and Repair Company	12,995	14
Staten Island Shipbuilding Company	13,886	13

The contract for these repairs has been placed with the W. and A. Fletcher Company Hoboken, New Jersey, low bidder for the work.

Atlantic Basin Works to Repair S.S. Eastern Sun

A CONTRACT for engine repairs to the steamship *Eastern Sun* was awarded recently to the Atlantic Basin Iron Works Corporation, Brooklyn, New York, by the Maintenance and Repair Division of the United States Shipping Board, 45 Broadway, New York City, at a price of $6,757. Other proposals received were as follows:

Name	Price
Todd Shipyards Corporation.....	$6,927
Staten Island Shipbuilding Company...	7,826
Morse Drydock and Repair Company...	9,170

W. and A. Fletcher Co. to Drydock S.S. West Selene

WITH a price of $4,840, the W. and A. Fletcher Company, Hoboken, N. J., was successful bidder for drydocking the steamship *West Selene,* bids for which were received recently at the office of the Maintenance and Repair Division of the United States Shipping Board, 45 Broadway, New York City. Other tenders received were as follows:

Name	Price
Morse Drydock and Repair Company....	$4,980
Todd Shipyards Corporation.....	5,928
Theodore Crane's Sons Company.....	6,083

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Morse Yard Awarded Repairs to S.S. City of Khartoum

BIDS were received and opened at the office of Thomas Niven, consulting engineer, 26 Beaver street, New York City, on Wednesday, March 16, for repairs to the steamship *City of Khartoum* formerly the *Karroo,* with the following results:

	Price	Days
Morse Drydock and Repair Company	$27,277	25
Tietjen and Lang Drydock Company	32,040	17
Robins Drydock and Repair Company	32,980	18
New York Harbor Drydock Company, Inc.	41,963	28

The contract for the work was awarded to the Morse Drydock and Repair Company, Brooklyn, New York.

N. Y., N. H. & H. R. R. Carfloat Repair Bids

TENDERS were received at New York on Wednesday, March 23, covering repairs to carfloat *No. 36,* of the New York, New Haven and Hartford Railroad Company, New Haven, Conn., with the following results:

Name	Price
Theodore Crane's Sons Company	$4,000
James Tregarthen and Sons Company, Inc.	4,250
John W. Sullivan	4,690
Staten Island Shipbuilding Company	5,478
Ira S. Bushey and Sons, Inc.	6,100
James Shewan and Sons, Inc.	6,194
Tietjen and Lang Drydock Company	6,340
Todd Shipyards Corporation	6,960
Morse Drydock and Repair Company	8,780

The award has not as yet been made.

Reconditioning Bids Opened for Three Shipping Board Vessels

TENDERS for the reconditioning of the steamships *Eastern Crag, Eastern Coast* and the *Eastern Guide,* which are being purchased by a Pacific Coast concern from the United States Shipping Board, were received and opened on March 14, at the office of Frank S. Martin and Son, 25 Broadway, New York City. Specification 1 and specification 2 are for reconditioning and specification 3 is for fitting hoppers. The vessels are to be used for carrying lime-stone. The bids received have been forwarded to the West Coast where the board of directors of the principals will determine which vessels are to be reconditioned. The plan is now to recondition two out of the three ships. The following proposals were submitted:

STEAMSHIP EASTERN CRAG

	Spec. 1	Days (1 & 2)	Spec. 2	Spec. 3	Days (3)
W. and A. Fletcher Company	$28,700	28	$15,600	$59,370	40
Tebo Yacht Basin Company	34,260	30	22,693	49,740	48
Staten Island Shipbuilding Co.	37,455	30	26,330	44,789	45
Theodore A. Crane's Sons Co.	38,510	25	21,675	54,565	35
Morse Drydock and Repair Co.	39,257	24	18,460	50,246	35
New York Harbor Drydock Co., Inc.	40,275	36	25,408	33,000	36
Federal Shipbuilding Company	42,500	45	27,300	53,900	100

STEAMSHIP EASTERN COAST

	Spec. 1	Days (1 & 2)	Spec. 2	Spec. 3	Days (3)
W. and A. Fletcher Company	$19,960	28	$11,700	$59,370	45
Tebo Yacht Basin Company	27,486	30	16,126	49,740	48
Theodore A. Crane's Sons Co.	28,025	25	13,350	54,565	35
New York Harbor Drydock Co., Inc.	29,460	36	12,943	33,000	36
Staten Island Shipbuilding Co.	29,725	30	16,670	44,789	45
Federal Shipbuilding Company	31,300	25	14,750	53,900	80
Morse Drydock and Repair Co.	33,488	18	13,400	50,246	35

STEAMSHIP EASTERN GUIDE

	Spec. 1	Days (1 & 2)	Spec. 2	Spec. 3	Days (3)
W. and A. Fletcher Company	$19,700	28	$14,600	$59,370	45
Tebo Yacht Basin Company	27,290	30	22,149	49,740	48
Theodore A. Crane's Sons Co.	29,015	25	19,775	54,565	36
Staten Island Shipbuilding Co.	29,490	30	25,184	44,789	45
New York Harbor Drydock Co., Inc.	29,580	36	24,313	33,000	36
Federal Shipbuilding Company	29,690	25	24,860	53,900	60
Morse Drydock and Repair Co.	32,672	20	18,450	50,246	35

New York Harbor D. D. Co. Awarded Repair Contract on S.S. Nile

THE New York Harbor Drydock Company, Inc., 17 Battery Place, New York City, has been awarded a contract for repairs to the steamship *Nile* of the United States Shipping Board, at a price of $5,643, bids for which were received at New York on Saturday, March 12. Other tenders received for the work are as follows:

Morse Drydock and Repair Company	$6,290
W. and A. Fletcher Company	6,469
Todd Shipyards Corporation	7,484
Newport News Shipbuilding and Drydock Company	7,890
Staten Island Shipbuilding Company	9,057
William Cramp & Sons Ship & Engine Bldg. Co.	10,109

Repair Contract on S. S. Satartia Goes to Morse D. D. Co.

THE Morse Drydock and Repair Company, Brooklyn, New York, has been awarded the contract for repairs to the Shipping Board steamer *Satartia,* at a price of $4,884.60, bids for which were received and opened in New York on Saturday, March 19. Other bids include:

Name	Price
Robins Drydock and Repair Company	$5,530.70
Theodore Crane's Sons Company	6,585.60
New York Harbor Drydock Company, Inc	7,551.75
James Shewan and Sons, Inc.	7,894.50

Dredge Pump Bids Received

TENDERS were received and opened at the War Department, United States Engineer Office, Room 428 Customhouse, St. Louis, Missouri, for the construction of a dredge pump, for 32-inch pipe-line dredge foot gauge. The bids were as follows:

Name	Price	
Hardie Tynes Manufacturing Company	$13,631	
Elliott Machine Corporation	14,533	
Walter Brothers Company	14,700	
Reading Iron Company	14,700	
Newport News Shipbuilding and Drydock Company	20,400	
Morris Machine Works	22,436	(1)
	22,046	(2)
	21,526	(3)

The award has not as yet been made.

Turbo-Electric Propulsion Units for U. S. Coast Guard Cutters

THE turbo-electric propulsion units of the first three of a total of 10 United States Coast Guard cutters, awarded to the Westinghouse Electric and Manufacturing Company, Pittsburgh, Pa. will consist of one main and two auxiliary turbo-electric sets. The main set, comprising a steam turbine, a-c generator and synchronous motor driving a single screw, will develop 3,000 shaft-horsepower at a speed of 163.5 revolutions per minute. The a-c generator, directly coupled to the turbine, will develop 2,600 kilowatts and the turbine working at a steam pressure of 250 pounds, with 250 degrees of superheat, will have a speed of 3,600 revolutions per minute. A vacuum of 28½ inches will be maintained.

The three-unit auxiliary sets will develop about 200 kilowatts each and are intended to supply excitation for the propulsion equipment and power to practically all auxiliaries. Under normal operating conditions this power is supplied by a synchronous motor coupled to the shaft of each auxiliary d-c generator.

Under ordinary cruising conditions, enough additional power is generated by the main driving unit to supply all auxiliary needs, the auxiliary turbines being used when in port, or while maneuvering, at reduced speeds. The picking up of the auxiliary load by the auxiliary sets when the cutter is steaming at reduced speeds is effected by an automatic control which operates the steam valve of the auxiliary turbines.

M. S. Crown City Starts Long Maiden Voyage

ONE of the longest maiden voyages in history began last month when the motorship *Crown City,* operated by the Roosevelt Steamship Line, sailed for Australian and Indian ports on a run that will carry her around the world in a little more than five months. The vessel was recently converted from steam to Diesel drive under the Shipping Board's $25,000,000 Dieselization program and was allocated to the Roosevelt Line, operators of the government's Atlantic, Australian and American Indian services.

The *Crown City* and five other motorships comprise the Australian fleet, but as the wool season will have ended by the time she reaches the Antipodes the vessel has been ordered on to the Indian ports served by the Roosevelt Line. Outward bound the motorship will pass through the Panama Canal, while on the homeward run she will traverse the Suez Canal.

The severe test to which the *Crown City* will be put on her voyage of circumnavigating the globe, is a splendid tribute to the condition of the ship. Most of the government's twelve vessels which were Dieselized were first assigned to a short haul voyage in order to tune up the engine and observe its working conditions.

Officials of the Roosevelt Line are elated over the showing being made by the motorship *West Honaker,* which sailed from New York on March 2 for Australia. The ship, they announced, made the run from Scotland Light to Cristobal in 6 days, 17 hours and 50 minutes, at an average speed of 12.6 knots, which is in excess of what the company expected.

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Notes from the Great Lakes

Pittsburgh S. S. Co. May Build Two More Freighters

IT is rumored that the Pittsburgh Steamship Company, Cleveland, Ohio, is now planning the construction of two more lake freighters, although no definite information can be obtained as to the date on which specifications will be issued.

It is believed, however, that the vessels will follow the same general characteristics as the two recently contracted for, which have an overall length of about 600 feet. The length on the keel of these vessels is 580 feet, beam 60 feet and depth 32 feet. Power is supplied by triple expansion engines and Scotch boilers.

M.S. Mascot Begins Season's Service

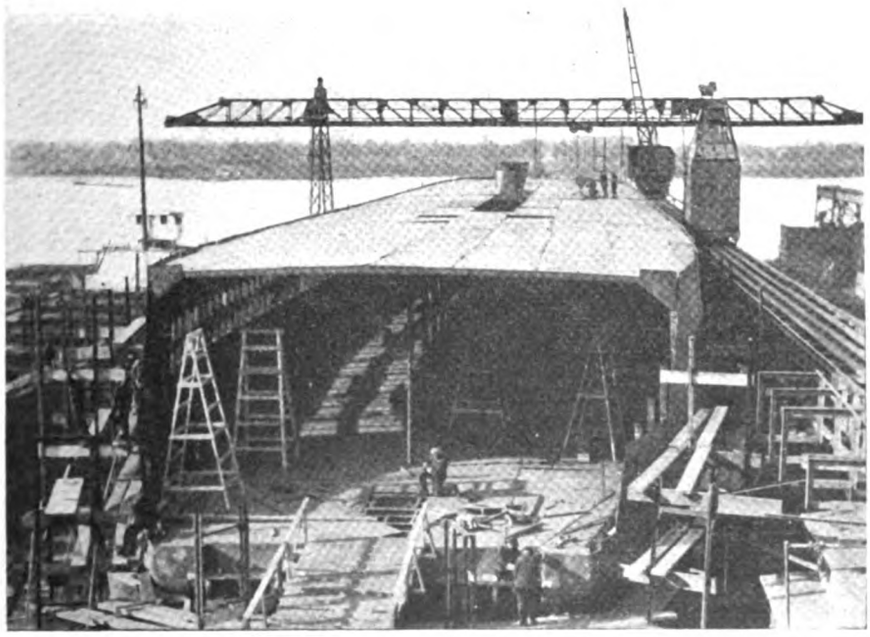
A DAILY round trip schedule between Put-in-Bay and Kelleys Island and Sandusky, O., was inaugurated March 1 by Capt. John Neuman, owner and master of the small oil burner *Mascot*, who expects to keep his craft in commission from now on.

Wyandotte Transportation Co. Denies Rumor

A RUMOR has been circulated that the Wyandotte Transportation Company, Detroit, Michigan, contemplates the sale of several of the freighters now operated by the company in order that plans can be drawn up for the building of new vessels The present fleet of the Wyandotte Company consists of four ships, the *Conneaut* of 4,749 gross tons; the *Huron* of 4,810 gross tons, the *Alpena* of 2,886 gross tons and the *Wyandotte* of 2,450 gross tons. The Wyandotte Transportation Company, in a recent letter, states that it has no intention of ordering the construction of new vessels at present.

Westinghouse Engineer Gives Lecture in Cleveland

C. J. LAMB of the large turbine section of the South Philadelphia works of the Westinghouse Electric and Manufacturing Company, gave an illustrated talk before the licensed officers of the Lake Carriers' Association in their club rooms in Cleveland on March 4. He discussed the general field and the application of marine turbines and auxiliaries and illustrated the talk with numerous lantern slides.

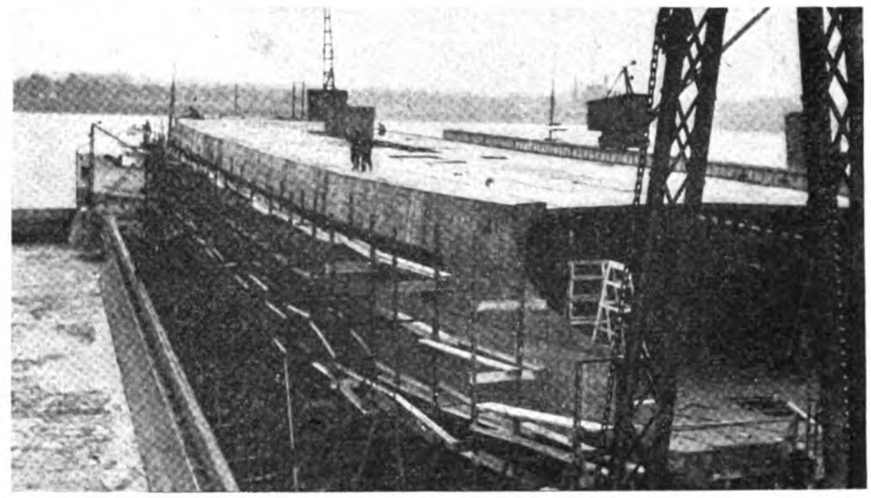


Wabash car ferry: Looking forward, showing upper deck and partial view of interior

Wabash Railway Contemplates Construction of Two Car Ferries

IT is understood that the Wabash Railway will soon be in the market for two new car ferries, which will be duplicates of the one contracted for last year with the Toledo Shipbuilding Company, Inc., Toledo, Ohio. This ferry has a length of 380 feet, draft of 16 feet and a width of 57 feet. The propelling machinery consists of two vertical triple expansion engines, steam being supplied by four Scotch boilers of 14 feet 6 inches in diameter, having a length of 12 feet.

The vessel was launched on March 19 and it is expected that she will go into service about May 15.



Wabash car ferry: Looking forward on port side

Chief of Army Engineers Inspects Cleveland Harbor

PLANS for revising the Lake Erie water front and harbor at Cleveland have been approved and await only formal revision by U. S. army engineers in Washington. Major General Edgar Jadwin, chief of the engineers, while in Cleveland last month, conferred with City Manager W. R. Hopkins regarding the harbor revision and the straightening of the Cuyahoga river. General Jadwin inspected the river and kinks which are to be eliminated. In a speech at a meeting of the Cleveland Engineering Society, reviewing the city's position with regard to the proposed St. Lawrence-Great Lakes sea route, he advised patience with regard to the government's construction program on the Great Lakes, saying that all but $15,000,000 of the work projected has been done and that additional construction will soon proceed. He stressed the need for more engineers and pointed out that Cleveland is a logical center for deep sea shipping under the proposed waterway through the St. Lawrence to the Atlantic.

Lake Erie Navigation Started on March 8

LAKE ERIE navigation started March 8 when two car ferries started from Conneaut with coal cargoes for Canadian ports. The *Marquette and Bessemer No. 2* took the lead and broke the ice on the Canadian side for the *Marquette and Bessemer No. 1*, which put in at Rondeau, *No. 2* continuing to Port Stanley.

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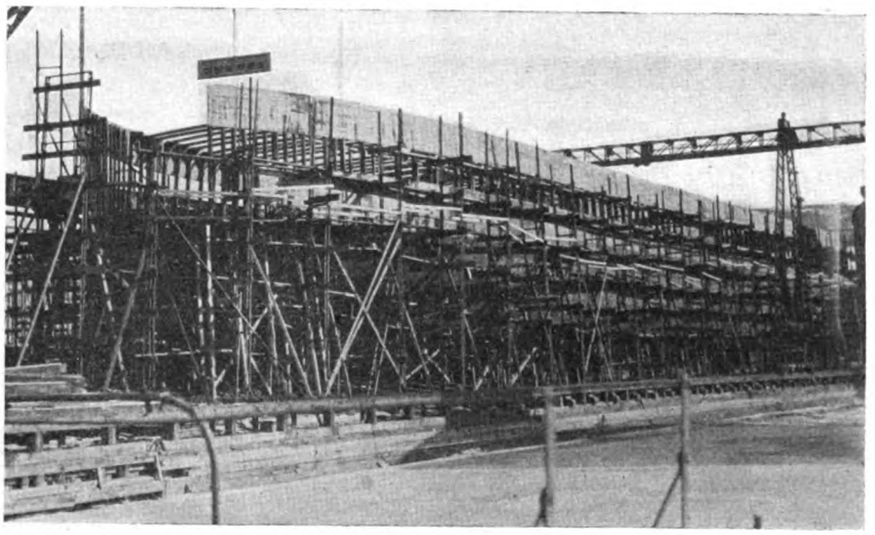

Wabash car ferry: Looking aft on port side

Shipping Executives Return from Vacation

Herbert K. Oakes, head of the Bethlehem Transportation Corporation, and Captain R. W. England, fleet manager of the Interstate Steamship Company, are back at their desks in Cleveland, after spending a month in the south.

D. & C. Boats Asked to Call at West Petsokey

Business men of West Petsokey, Mich., have asked the Detroit and Cleveland Navigation Company to make that place a port of call for the Detroit-Mackinac Island, Chicago boats. A. A. Schantz, president of the company, promised half an hour stop-over if the harbor and dock are made suitable for big passenger vessels.

Regular Service Between Detroit and Cleveland Begins

THE Detroit & Cleveland Navigation Company began regular daily service between Detroit and Cleveland on March 29.

Fitting out of the *City of Detroit III* and *City of Cleveland III* was begun in ample time for the opening. The *Detroit* is the first passenger boat of the season to sail from Detroit, leaving there at 10 a. m., March 29, and leaving Cleveland on her return at 11:30 the same night. The *Cleveland* left Detroit at 11:30 p. m. on the opening date.

The tentative date for opening of the Buffalo division is May 15, and the Detroit, Mackinac Island and Chicago boats will start June 23. All steamers carry freight during the season which is stored on the main deck instead of the hold. Direct connections are made at all important ports with railroads.

To Improve Duluth-Superior Harbors

AN active campaign urging improvement of the Duluth-Superior harbors is under way in Duluth which has the backing of the local civic organizations and the city planning commission. Anticipation of the ultimate completion of the St. Lawrence waterway route is accelerating the harbor improvement plan, according to Duluth papers.

Among other things, it is planned to have a joint harbor commission, with both Minnesota, and Wisconsin having representatives on it. A bill already has been introduced in the Minnesota legislature, providing for the organization of such a commission, and it is said a similar one will be presented to the Wisconsin legislature.

General Motors Building Automobile Loading Dock

THE General Motors of Canada is constructing an unique dock for loading automobiles at its Oshawa plant. The loading dock will more than treble the facilities for railway shipment of completed cars. The dock will cost $40,000, being one of a unit of the $800,000 expansion program of the company which proposes to increase its daily output of 144 cars to 456.

Pier Light Changed at Fairport

The Fairport, Lake Erie, west pier light in the harbor will be changed at the opening of navigation to flashing white, according to an announcement of the lighthouse division service of the Geodetic Survey.

Toledo Furnace Plant to Expand

THE Toledo, O., Furnace Company's plant will expend more than $1,000,000 in an expansion program. This concern is affiliated with the Pickands, Mather and Company, Cleveland ore and miner owners and operators of the Interlake Steamship Company of which Harry Coulby is the president. Increased production because of new inventions which decrease costs led to the contract for new equipment. Dwight P. Robinson and Company, of New York, will construct the addition.

First Vessels to Take on Coal

The freighters *Captain Thomas Wilson*, *Edward A. Urig* and *James McNaughton* in winter quarters in Cleveland were the first to take on coal at the West Sandusky, O., Pennsylvania docks on March 13.

Lake Vessel Repairs

Quite a lot of vessel repairing is reported along the Great Lakes shipyards. Much of the work was occasioned by accidents last season. The steamer *Fontana* was damaged by fire recently and has been sent to the Toledo Shipbuilding Company's yard in Toledo.

The *Canadoc* and *Yukondoc*, freighters of the Paterson Steamship Company, have been repaired at Port Arthur and taken from dry dock.

The freighter *Huronic* has been dry docked at Sarnia and several damaged plates will be removed. She rammed a dock on her port side.

The tug *James Whalen* has been docked at Port Arthur for repairs. She was damaged in a collision.

The steamer *F. J. Peterson*, named for her owner, is undergoing reconstruction in Detroit. The contract was let to the Detroit Railway & Harbor Terminals Company. It is proposed to change the deck to facilitate loading and unloading. The vessel was bought a year ago from the United States Shipping Board.

The *Tashmo* damaged her port side forward when she hit a Detroit dock in making a landing and has been drydocked.

The steamer *Frank Seither* and freighter *W. H. Becker* are undergoing repairs at Buffalo. The *Seither* has damaged bearings and engine bed foundation, while the *Becker* smashed several plates on her port side.

The *William Nottingham* is having damaged plates and frames repaired at Buffalo.

The *Westland* of the Thompson Transit Company is getting several new plates at Detroit.

The steamer *Sandmaster* damaged her port propeller when she hit an obstruction in North Branch river and is now being repaired at South Chicago.

The steamer *Maplebrook* is at Sarnia where damages done when the vessel hit a bridge in Lachine canal are being repaired.

The *Peter Reiss* of the Reiss Steamship Company has been docked at Manitowoc, Wis., for repairs.

The tug *Manistique* of the Reid Towing and Wrecking Company of Sarnia, has been drydocked for repairs.

The steamer tug *Lorain*, after ramming ice in Lake St. Clair, sprang a leak and has been drydocked for repairs at River Rouge yards.

The steamship *Saskatchewana* has been docked at Owen Sound for repairs. The vessel had a hole knocked in her side during a collision with the steamer *Robert J. Paisley*.

The steamship *John A. Kling* has been drydocked at the yards of the Great Lakes Engineering Works, River Rouge, Michigan, for repairs. The vessel has 11 damaged plates.

Fitting Out the Pittsburgh Fleet

The fleet of the Pittsburgh Steamship Company is being fitted out for the 1927 season. First of the chief engineers began fitting out March 7.

Change of Vessel's Name

The Pioneer Steamship Company has changed the name of the steamer *Wilpen* to the *David P. Thompson*.

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Mobile Diesel Tugboat Bids Rejected—New Proposals to Be Asked

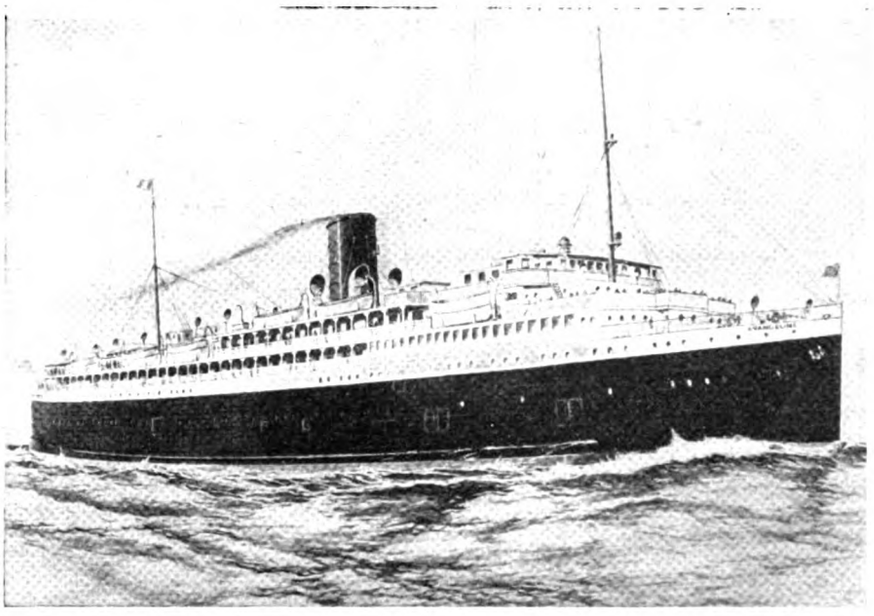
THE tenders received and opened by the United States Engineer Office, Mobile, Ala., on February 7, for the construction of a steel Diesel-electric harbor tug, have been rejected. It is expected that new bids will shortly be called.

Coast Guard Will Appoint Three Constructors

THE United States Coast Guard, Treasury Department, Washington, D. C., is contemplating the appointment of three constructors, who will be commissioned officers in the service and who will perform duty in connection with the construction and repair of Coast Guard vessels and boats. Applications to be considered for the next examination must be received at Coast Guard Headquarters not later than April 15, 1927. Further information may be obtained on application.

Roosevelt and Franklin Form New Shipping Concern

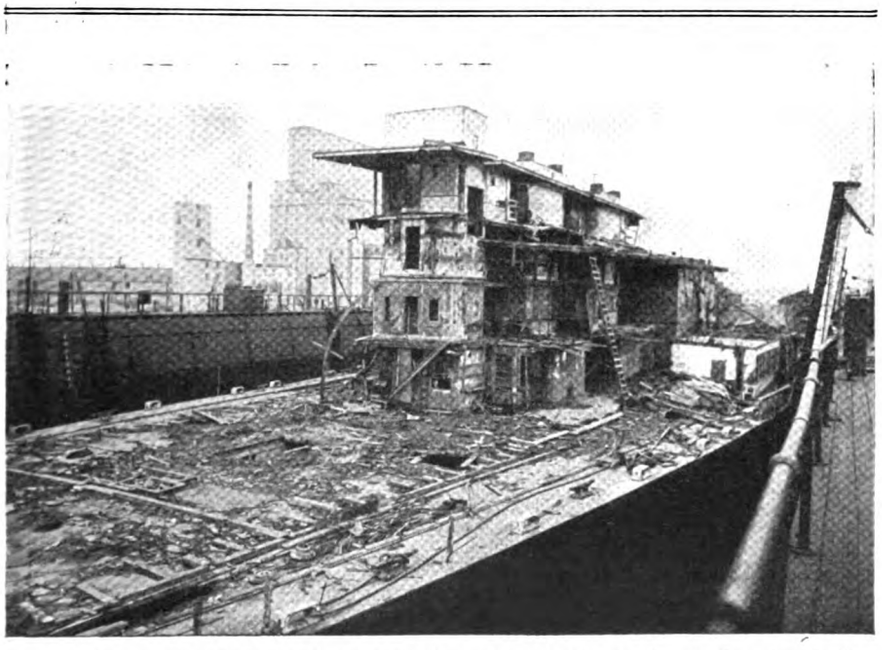
KERMIT ROOSEVELT and John M. Franklin, two of New York's young shipping leaders, have formed a new shipping company for the object of developing American flag shipping. Mr. Franklin, who is a son of P. A. S. Franklin, president of the International Mercantile Marine Company, New York, will become vice-president of the new corporation, which will be known as Roosevelt and Franklin, Inc., of 16 Beaver Street. In addition, Basil Harris, for many years connected with the Australian department of Norton, Lilly and Company, will also join the company as a vice-president. Mr. Roosevelt will serve as president.



S. S. Evangeline of the Eastern Steamship Lines, Inc., as she will look when she inaugurates the New York-Yarmouth service of the company this summer

Standard Transportation Company Rejects Bids for Three Tankers

INFORMATION has been received that the bids for the construction of three twin screw oil tankers for the Standard Transportation Company, New York have been rejected and that no further bids will be called for at this time. Various proposals were received by the Standard Transportation Company for equipping these vessels with Diesel propelling machinery, turbine machinery and reciprocating engines. No reason was given at this time for the rejection of bids or any indication whether the matter would be taken up later or not.



The remains of the Hudson River Day Line steamer Washington Irving dry docked at the Clinton plant of the Todd Shipyards Corporation for survey

TRADE PUBLICATIONS

MARINE GENERATING SETS.—The special features of an improved marine generating set manufactured by Engberg's Electric & Mechanical Works, St. Joseph, Mich., are outlined in a folder now being issued by this company.

HYDRAULIC DREDGES.—The American Brown Boveri Electric Corporation, 165 Broadway, New York, announces the publication of Bulletin No. 900 on hydraulic dredges and Bulletin No. 901 on floating pipe lines for hydraulic dredges.

COLUMBIAN BRONZE PROPELLERS.—The Columbian Bronze Corporation, Freeport, Long Island, has issued a catalogue on the subject of bronze propellers for various types of service. Tables of standard propellers and details, as well as many types of special propellers, are covered in the subject matter.

STEEL PRODUCTS.—Catalogue "K" issued by the Bethlehem Steel Company, Bethlehem, Pa., has been prepared for the purpose of presenting information relative to Bethlehem products for use in industrial track construction. All manner of materials for use in this connection, including rails, switches, ties and the like are illustrated and described in detail.

UNIVERSAL VARIABLE DELIVERY PUMP.—The Universal variable delivery pump as applied to ships' steering gears is the subject of a catalogue issued by the Waterbury Tool Company, Waterbury, Conn. The Bulletin is in the main devoted to illustrations covering the applications of this pump to a number of different types of electro hydraulic steering gears for merchant ship and naval service.

TIDE TABLES.—A small booklet being sent out by the Morse Dry Dock & Repair Company, Brooklyn, N. Y., contains tide tables for the port of New York for each month of the year, as well as a number of tables of useful information such as the

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officials of the port of New York, distances in nautical miles from New York to the more important ports of the world and a list of the foreign consuls at New York.

De Laval Pumps at Greensboro, N. C.—Under this title the De Laval Steam Turbine Company has described a pumping system in which an original capacity of 4,500,000 gallons daily was increased to an ultimate 22,000,000 gallons daily without expenditure for new buildings, and with a marked improvement in fuel economy, by the substitution of steam turbine driven centrifugal pumps for Corliss and Meyer valve gear, crank and fly wheel units.

Cutless Bearings.—Cutless rubber bearings for marine and stationary service and cutless sealing rings and sleeves are described in detail in two catalogues issued by the B. F. Goodrich Rubber Company, Akron, O. In the marine catalogue ships of various classes on which cutless rubber bearings have been installed are illustrated. Special attention is called to the installation on the tug *Madison* owned by the Delaware & Lackawanna Railroad, the Diesel electric barge *J. H. Senior*, owned by the Standard Oil Company of New Jersey and the ferryboat *Golden State*, operated by the Golden Gate Ferry Company at San Francisco, Cal.

BUSINESS NOTES

Steward Davit and Equipment Corporation has moved from 17 Battery Place to 342 Madison avenue, corner 44th street, New York.

Henry L. Schweppe has been appointed manager of the Southern marine department of the Automobile Insurance Company at Atlanta, Ga.

Frank J. Donnelly has joined the New York office of Botfield Refractories Company, Philadelphia, Pa., and will cover the New Jersey territory under the direction of Chas. C. Phillips, New York district manager.

The Kerr Steamship Company of 44 Beaver street, New York, has opened its own office at Norfolk, Va., which will be in charge of C. M. Snyder. Graham and Company were appointed agents in Calcutta, India, for the Pacific Coast-Java-Calcutta monthly service, which is to begin from the Pacific Coast in May.

F. A. Weymouth, formerly sales metallurgist of the Bethlehem Steel Company, has been elected vice-president of the Burden Iron Company with headquarters at Troy, N. Y. Mr. Weymouth graduated from the Lawrence Scientific School, Harvard University in 1906 and for several years served as engineer of tests of the Maryland Steel Company.

The Harold E. Trent Company of Philadelphia, Pa., has moved to larger premises at 439-443 North 12th street. It is the intention of this company to develop large size metal pots and pot furnaces up to 1,700 degrees F., in addition to their standard line of metal melting pots up to 1,500 pounds capacity and 1,000 degrees F. Besides melting pots and pot furnaces, this firm also manufactures soldering irons, solder troughs, calibration tanks, etc.

The Billings and Spencer Company, manufacturers of the "Triangle B" line of drop forged tools special forgings and forging machinery, with general offices and works in Hartford, Connecticut, has transferred Mr. Howard E. Oberg, who has had fifteen years practical experience in the forging industry embracing all departments, to be directly in charge of Sales Engineering for their complete machinery line in the Middle West, with headquarters in Room 5-251, General Motors Building, Detroit, Michigan.

Joseph G. Worker has been appointed general sales manager and also elected to the board of directors of the American Engineering Company, Philadelphia, Pa. Mr. Worker is a graduate of the University of Illinois with the degree of B. S. in mechanical enginering, is a member of the American Society of Mechanical Engineers, a former president of the Stoker Manufacturers' Association and is widely known as a writer of articles on combustion engineering and co-author of a work on mechanical stokers. He was associated with the Westinghouse Companies for 15 years, and for the last five years of this period was manager of the stoker section of the Westinghouse Electric and Manufacturing Company at East Pittsburgh.

The Canadian Power Specialty Company, Limited, a new company which has purchased the plant of the former Engineering and Machine Works of Canada, Limited at St. Catharines, Ont., is to manufacture and sell Foster power plant equipment in the dominion. In addition to Foster superheaters, economizers, water backs, furnace surfaces and tubular oil stills, the line includes Aero unit coal pulverizers. The plant at St. Catharines includes foundry, pattern shop, machine shop, boiler shop, erecting shop, office, etc., and has a steady trade of pulp and paper mill machinery, and special machine work to meet the requirements of manufacturers without their own shops. The plant is on the Welland Canal and served by two railway sidings, so that it is centrally located and in close touch with large sources of supplies and a good labor market.

The entire Sprague portable hoist business of the General Electric Company was taken over by the Shepard Electric Crane & Hoist Company of Montour Falls, N. Y. on April 1. Sprague hoists have been built in the Bloomfield plant of the General Electric Company since 1903. The Shepard Company will continue the manufacture of this line and has established for this purpose a division known as the Sprague Hoist Division of the Shepard Electric Crane & Hoist Company, with offices at 30 Church Street, New York City. N. A. Hall, of the General Electric Company, will take charge of the new Shepard division, after 14 years of service with General Electric. The Shepard Company will furnish spare parts for obsolete types of Sprague hoists as well as for the current line. The General Electric Company will continue to manufacture the parts for motors which have been used on Sprague hoists, and parts for controllers and brakes, but this business will be handled commercially by the Shepard Electric Crane & Hoist Company.

Marine Societies

America

American Marine Association. 30 Church St., New York. President—Col. E. A. Simmons.

American Marine Standards Committee. Chairman, Colonel E. A. Simmons. Secretary, A. V. Bouillon, Division of Simplified Practice, Department of Commerce, Washington, D. C.

American Society of Marine Designers. Secretary—B. G. Barnes, 202 Kendrick Ave., Quincy, Mass.

American Society of Marine Engineers. 605 Market St., San Francisco, Calif. President—Henry F. Gelhaus. Secretary—Wm. H. Thille.

American Society of Naval Engineers. Navy Department, Washington, D. C. Secretary-Treasurer—Commander H. B. Hird, U. S. N., Bureau of Engineering, Navy Department, Washington, D. C.

American Steamship Owners' Association. 11 Broadway, New York. President—Alfred Gilbert Smith.

Atlantic Coast Shipbuilders' Association. 1600 Walnut Street, Philadelphia, Pa. Secretary—C. S. King.

Council of American Shipbuilders, Inc. 30 Church St., New York. President—Homer L. Ferguson. Secretary-Treasurer—Henry C. Hunter.

Jersey Marine Club, 4th and River streets, Hoboken, N. J. President—Col. Bartlett.

Lake Carriers' Association. President—J. S. Ashley. Secretary—George A. Marr, Rockefeller Building, Cleveland, O.

National Association of Engine and Boat Manufacturers. 29 West 39th Street, New York City. Secretary—Ira Hand.

National Association of Masters, Mates and Pilots. National Secretary—M. D. Tenniswood, 308 Vine St., Camden, N. J.

National Marine Engineers' Beneficial Association. Headquarters, 311-315 Machinists Building. Washington, D. C. President—Wm. F. Yates. Secretary—Albert L. Jones.

National Merchant Marine Association. Munsey Bldg., Washington, D. C. President—Hon. J. E. Ransdell.

Neptune Association. 21 Pearl St., New York City. Secretary-Treasurer—Captain John F. Milliken.

New York and New Jersey Dry Dock Association, 111 Broadway, New York. President—Jonathan Moore.

Ocean Association of Marine Engineers. 15 Whitehall St., New York. Secretary—Bert L. Todd.

Port of New York Authority. 75 West Street, New York. Chairman—George S. Silzer. Secretary—Wilson J. Vance.

Society of Naval Architects and Marine Engineers. 29 West 39th Street, New York. Secretary and Treasurer—Daniel H. Cox.

The Maritime Association of the Port of New York. 78 Broad St., New York City. President—John Dowd. Secretary—John F. Manning.

The New York Tow Boat Exchange. 11 Moore St., New York. Manager—Charles A. Mason.

The Propeller Club of the Port of New York. President—Edward A. Colson, 85 Liberty Street, New York. Secretary—William C. Gray, 17 Battery Place, New York.

United States Naval Institute. Naval Academy, Annapolis, Md. Secretary and Treasurer—Captain H. A. Baldridge, U. S. N.

United States Ship Operators' Association. 149 Broadway, New York. President—Winchester Noyes.

Canada

Grand Council N. A. of M. E. of Canada. Grand Secretary-Treasurer—W. A. MacDonald, 62 Albert St., Halifax, N. S.

Great Britain

Institute of Marine Engineers, Incorporated. 85/88 The Minories, London, E.1.

Institution of Engineers and Shipbuilders in Scotland. 39 Elmbank Crescent, Glasgow.

Institution of Naval Architects. Adelphi Terrace, London, W. C.

Northeast Coast Institution of Engineers and Shipbuilders. Bolbec Hall, Westgate Road, Newcastle-on-Tyne.

France

Association Technique Maritime et Aéronautique. Secrétariat Général—7, rue de Madrid, Paris (8e).

Italy

Collegio Degli Ingegneri Naval e Meccanici in Italia.

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